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AMERICAN
NATIONAL STANDARD
SAFETY CODE FOR

Elevators Dumbwaiters Escalators and Moving Walks

ANSI A17.1-1971

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AMERICAN NATIONAL STANDARD
SAFETY CODE FOR

Elevators, Dumbwaiters, Escalators and Moving Walks

Covering their design, construction, installation, operation, inspection, testing, maintenance, alteration and repair

ANSI A17.1-1971

secretariats

National Bureau of Standards
The American Institute of Architects
The American Society of Mechanical Engineers

published by

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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FOREWORD

The first edition of the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators was published in January, 1921. It was prepared by an ASME Committee on Protection of Industrial Workers with the assistance of representatives of a number of interests including manufacturers, insurance carriers, regulatory bodies and technical societies.

The application of this Code in the formulation of various state and municipal codes emphasized the need for its further development and extension. Accordingly, The American Society of Mechanical Engineers requested the American Standards Association to authorize the organization of a Sectional Committee to undertake this revision. The ASA acted favorably on this request and in January, 1922, assigned sponsorship for the project jointly to the American Institute of Architects, the National Bureau of Standards, and The American Society of Mechanical Engineers, all three of whom had taken an active part in the preparation of the first edition of the Code.

The organization meeting of the Sectional Committee A17 was held in November, 1922. A number of meetings of the Committee were held during the next two years and in July, 1925, a revision of the 1921 Code was completed, approved by the ASA, and published as an American Standard.

Subsequent to the publication of the 1925 revision of the Code, the necessity for development research on the design and construction of car safeties and oil buffers and for the development of test specifications for various parts of elevator equipment was realized.

As a result, a Subcommittee on Research, Recommendations and Interpretations was appointed in 1926. This subcommittee held regular meetings thereafter until interrupted by the war in 1940, and carried on an extensive test program at the National Bureau of Standards in connection with oil buffers and car safeties. Subsequent to the war, the name of this subcommittee was changed to "Executive Committee for the Elevator Safety Code."

The information gained as a result of these tests and the experience derived from the adoption and enforcement of the 1925 Code by various states and municipal enforcing bodies, together with the developments which had occurred in the design of the equipment as a result of installations made in very tall buildings, prompted the Sectional Committee to prepare and issue the third edition of the Code in 1931.

The third edition was approved by the Sectional Committee in February, 1931, and subsequently by the sponsors and by the American Standards Association in July, 1931.

Further experience derived from the adoption and enforcement of the 1931 edition, and developments in the design of elevator equipment, led the Sectional Committee, in line with its policy of revising the Code periodically, to prepare the fourth edition in 1937 which was approved by the sponsors and by the American Standards Association in July, 1937.

A fifth revision of the Code was well under way in 1940 when it was necessary to suspend the work due to the Second World War. However, a number of the revisions already agreed upon by the Sectional Committee and approved by the sponsors and by the American Standards Association in April, 1942, were issued as a supplement to the 1937 edition. They were subsequently incorporated in a reprint of the 1937 edition in 1945.

The Sectional Committee began consideration of a fifth revision of the Code in 1946. Due to the considerable period which had elapsed since the fourth revision in 1937, and to the very extensive developments in the elevator art, the committee decided that the Code should be completely rewritten and brought up to date.

Special subcommittees were appointed to prepare the revisions of the various requirements. The membership of each subcommittee consisted of persons especially familiar with the requirements to be covered by that subcommittee. Fifteen subcommittees were set up with a total membership of over one hundred and fifty persons. The membership of these subcommittees was not confined to members of the Sectional Committee. It also included other persons having expert knowledge of the subjects under discussion by the subcommittees. These subcommittees and their personnel were listed in the 1955 edition of the Code.

The drafts prepared by these subcommittees were widely circulated for comment to interested groups. After review of the comments and correlation of the drafts, the fifth edition of the Code was approved by the Sectional Committee, subsequently by the sponsors and by the American Standards Association in June, 1955.

In December, 1957, a Supplement to the Code listing a number of revisions was approved by the American Standards Association and published by the ASME.

A sixth edition was published in 1960 which incorporated the revisions contained in the 1957 Supplement as well as approximately 96 revisions which were approved by the Sectional Committee in March, 1960.

In 1958 the scope of the A17 Sectional Committee was enlarged to include moving walks. The membership of the Sectional Committee

was expanded to include manufacturers whose primary interest on the Committee was the development of rules and regulations on moving walks. A subcommittee prepared a Safety Code for Moving Walks which was approved by the Sectional Committee, the Sponsors, and by the American Standards Association on March 20, 1962. This Code was published as Part XIII of the A17.1 Code, and was designated ASA A17.1.13-1962.

During 1962 and 1963, thirty-eight additional changes to Parts I to XII of A17.1 were approved by the Sectional Committee, the Sponsors, and the American Standards Association, and were published as the 1963 Supplement to the 1960 edition of the Code.

A seventh edition was published in 1965 which incorporated the Safety Code Rules for Moving Walks ASA A17.1.13-1962 as Part XIII, the revisions covered by the 1963 Supplement as well as approximately 90 revisions approved by the Sectional Committee, the Sponsors, and the American Standards Committee.

On August 24, 1966, the American Standards Association was reconstituted as the United States of America Standards Institute. The designation of Standards approved as American Standards was changed to USA Standards. There was no change in the index identification or the technical content of the standards. At the same time the ASA Sectional Committee, A17 on A Safety Code for Elevators was changed to the USA Standards Committee, A17 on A Safety Code for Elevators.

The United States of America Standards Institute changed its name to American National Standards Institute, Incorporated on October 6, 1969. At the time that the new name became effective the designation USA Standard was changed to American National Standard and the name of committees changed from USA Standards Committees to American National Standards Committees. The alphabetical designations of standard documents was changed from USA to ANSI.

Four supplements to the seventh edition (1965) of the code containing revisions approved by the Standards Committee, the Sponsors, and the United States of America Standards Institute (American National Standards Institute, Inc.) were published as USAS A17.1a in 1967, USAS A17.1b in 1968, USAS A17.c in 1969 and ANSI A17.1d in 1970.

The A17 Standards Committee is continually considering suggestions for revisions to the Code to keep it up-to-date with the elevator art. The Standards Committee meets annually in June. Additional special meetings are held when necessary. The Executive Committee meets six to ten times a year depending on the work load. Generally, recommendations concerning proposed revisions to the Code are first made by the Revisions Subcommittee to the Executive Committee. Final approval, rejection or modification of proposed revisions is the responsibility of the Standards Committee.

This edition of the Code, which becomes the Eighth Edition, incorporates the revisions covered by supplements A17.1a-1967, A17.1b-1968, A17.1c-1969, and A17.1d-1970 and in addition, 94 revisions or additions which were approved by the Standards Committee, the Secretariats (formerly Sponsors), and on July 27, 1971 by the American National Standards Institute, Inc.

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PREFACE

GENERAL

This Code is one of a series of safety codes which have been or are being formulated under the general auspices of the American National Standards Institute, Inc. It is intended to serve as a guide for state and municipal authorities in drafting regulations governing the installation and maintenance of elevators, dumbwaiters, private residence inclined lifts, escalators, and moving walks.

The Code is also intended as a standard reference for safety requirements for the guidance of architects, engineers, casualty insurance companies, and manufacturers and as a standard of practice for owners and managers of structures where equipment under the scope of this Code is used.

It is recommended that, prior to adoption, all pertinent state and local laws or ordinances be reviewed and where there is a conflict with any of the rules of this Code an exception to such conflicting rules be noted, quoting the section of the law which applies.

FORM AND ARRANGEMENT

The form and arrangement used in the previous (1965) edition have been modified. Parts I and II apply to electric elevators and all rules and exception to rules that pertained exclusively to other Parts have been moved to the Part to which they pertain. Parts III, IV, VI and VII have been rearranged to follow the form of Parts I and II. Part XIII has been renumbered Part IX. The acceptance and periodic tests and inspections and maintenance have been combined in one Part, Part X. Engineering and type test have been placed in a separate Part, Part XI. Previous Parts XI and XII have been renumbered and are now Parts XII and XIII respectively. A scope has been added to each Part. Each rule has been given an appropriate title with a rule number to facilitate indexing. In some cases the rules in this edition have the same numbers as corresponding rules in the 1965 edition, but where the form of a Part has been rearranged or the Part number changed, the rules have different numbers. Some of the titles, as well as some of the rules have been modified.

Revisions as published in supplements A17.1a-1967, A17.1b-1968, A17.1c-1969, A17.1d-1970 are indicated by a single asterisk (*) and those revisions adopted in 1970 are indicated by double asterisks (**).

DEFINITIONS

In addition to terms used in the text, a number of other terms are defined for the convenience of architects, engineers, manufacturers, and building owners and to promote standardization of nomenclature and terminology in industry. Some definitions have been revised and some new ones have been added since the 1965 edition of the Code.

APPLICATIONS OF RULES TO EXISTING EQUIPMENT

Not all rules of the Code apply to equipment installed prior to its adoption by state and municipal authorities, but those which do apply to existing as well as to new installations are outlined under "Scope" in the introduction.

The Code contains many rules intended to obviate hazards which can be avoided in new installations; but, if such rules were made to apply to existing installations, they would entail financial outlay out of proportion to the benefits derived.

Accident records, compiled on a nationwide basis during the last few years, indicate that a large percentage of all elevator accidents on the older installations occur at the entrance openings to the hoistway or to the car. It is, therefore, recommended that, as a minimum, the rules covering safety requirements for hoistway and car doors be made to apply also to existing installations.

The accident records further indicate that numerous accidents have ocurred on the older existing equipment, especially where a winding drum type machine was used, and where the car safety device and the terminal stopping devices were either absent or inadequate. It is, therefore, recommended that adequate undercar safeties and terminal stopping devices be required for existing installations.

The adopting agency, on the basis of experience supported by accident records, should decide what requirements, if any, are to apply to existing equipment.

It is recommended that a local committee, consisting of representatives of groups directly interested, be appointed to study the existing local conditions and determine what requirements should be made to apply to the existing equipment. Representatives of the following groups should be included:

(a) Building owners and managers
(b) Real estate management companies
(c) Architects and consulting engineers
(d) Manufacturers of the equipment
(e) Elevator maintenance companies

(f) Casualty and fire insurance companies
(g) City and state enforcement officials
(h) Elevator labor unions

PRIOR PUBLICATION OF RULES AND PUBLIC HEARING

Prior to adoption of the Code a public hearing should be held to permit all interested parties to voice any objections they may have to particular rules and to provide an opportunity for the adopting authority to explain the reasons for such rules. Many state laws and city ordinances require such hearings, but even where not required it is strongly recommended that hearings be held.

Drafts of the proposed Code should be made available to all interested parties at least thirty (30) days prior to the date set for the public hearing.

INSPECTION OF ELEVATORS

The Standards Committee has also prepared a separate manual to serve as a practical guide for the inspection and testing of elevators, dumbwaiters and escalators. It bears the title, "American Standard Practice for the Inspection of Elevators, Inspectors' Manual," American Standard A17.2.

The Inspectors' Manual is intended to serve as a guide for the inspection and testing not only of new equipment but also existing equipment which does not conform to the requirements of the Code.

REVISIONS AND INTERPRETATIONS

The rules of the Code will be revised periodically to incorporate changes which appear desirable or necessary, as demonstrated by the experience gained from the application of the rules by various enforcing authorities and in order to conform to the developments in the elevator art.

The Executive Committee will, on request, render an interpretation of any rule and all suggestions for changes or requests for interpretation should be addressed to:

The Executive Committee on Safety Code for Elevators
c/o The American Society of Mechanical Engineers
United Engineering Center, 345 East 47th Street
New York, New York 10017

All interpretations made by the Executive Committee are reviewed by the Standards Committee at its Annual Meetings.

REFERENCE CODES, STANDARDS AND SPECIFICATIONS

Reference has been made in the rules of this Code by number and date to the following codes, standards and specifications:

American National Standards Institute, Inc.
1430 Broadway
New York, New York 10018

ANSI A2.1-1970 Methods of Fire Tests of Building Construction and Materials.

ANSI A2.2-1968 Methods of Fire Tests of Door Assemblies.

ANSI A2.5-1963 (ASTM E84-61) Method of Test for Surface Burning Characteristics of Building Materials.

ANSI A10.2-1944 Safety Code for Building Construction

ANSI A10.4-1963 Safety Requirements for Workmen's Hoists.

ANSI A12.1-1967 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.

ANSI A17.2-1960 (including Supplements A17.2a-1965 and A17.2b-1967) American Standard Practice for the Inspection of Elevators, Inspectors' Manual

ANSI A89.1-1964 (ACI 318-63) Building Code Requirements for Reinforced Concrete.

ANSI A90.1-1969 Safety Standard for Manlifts.

ANSI B2.1-1968 Pipe Threads (Except Dryseal).

ANSI B20.1-1957 Safety Code for Conveyors, Cableways, and Related Equipment.

ANSI B29.1-1963 Transmission Roller Chains and Sprocket Teeth.

ANSI B29.2-1957 Inverted Tooth (Silent) Chains and Sprocket Teeth.

ANSI B31.1.0-1967 Power Piping.

ANSI B55.1-1961 Specifications for Multiple V-Belt Drives.

ANSI C1-1968 (NFPA 70-1968) National Electrical Code.

ANSI G50.1-1967 (ASTM A27-65) Specifications for Mild-to-Medium Strength Carbon-Steel Castings for General Application.

ANSI O4.3-1969 (ASTM 245-64T) Methods of Establishing Structural Grades of Lumber.

ANSI Z11.211-1968 (ASTM D2270-64) Method of Test for Pour Point.

ANSI Z11.45-1953 (ASTM D567-53) Method for Calculating Viscosity Index. (Was withdrawn on Jan. 11, 1968.)

ANSI Z97.1-1966 Performance Specifications and Methods of Test for Transparent Safety Glazing Material Used in Buildings.

American Gear Manufacturers Association
Standards Department
1330 Massachusetts Ave., N.W.
Washington, D.C. 20005

AGMA 420.03-1963	Helical and Herringbone Gear Speed Reducers.
AGMA 430.03-1963	Speed Reducers and Increasers Employing Spiral Bevel Gearing.
AGMA 440.03-1959	Practice for Single and Double-Reduction Cylindrical-Worm and Helical Worm-Speed Reducers.
AGMA 441.03-1963	Practice for Single and Double-Reduction, Double-Enveloping Worm and Helical-Worm Speed Reducers.
AGMA 460.04-1965	Practice for Gearmotors.
AGMA 480.03-1965	Practice for Helical, Herringbone and Spur Gear Shaft Mount Speed Reducers.

American Institute of Steel Construction
101 Park Avenue
New York, New York 10017

AISC Specification for Design Fabrication and Erection of Structural Steel for Buildings, April 17, 1963.

The American Society of Mechanical Engineers
United Engineering Center
345 East 47th Street
New York, New York 10017

ASME Code for Unfired Pressure Vessels (Sect. VIII Division 1 of ASME Boiler and Pressure Vessel Code, 1968).

American Society for Testing and Materials
1916 Race Street
Philadelphia, Pennsylvania 19103

ASTM A36-67	Specifications for Structural Steel.
ASTM A235-67	Specifications for Carbon Steel Forgings for General Industrial Use.
ASTM A283-67	Specifications for Low and Intermediate Tensile Strength Carbon Steel Plate of Structural Quality.
ASTM A307-67	Specifications for Steel Machine Bolts, and Nuts, and Tap Bolts.
ASTM A502-65	Specifications for Steel Structural Rivets.
ASTM D198-67	Methods of Static Tests of Timbers in Structural Sizes.

National Fire Protection Association
80 Batterymarch Street
Boston, Massachusetts 02110

NFPA No. 13-1969	Sprinkler Systems.
NFPA No. 80-1970	Fire Doors and Windows.
NFPA No. 101-1970	Life Safety Code.

Society of Automotive Engineers
2 Pennsylvania Plaza
New York, New York 10001

SAE 100-R2-1967	High Pressure Steel Wire Reinforced Rubber Covered Hydraulic Hose.

U.S. Department of Commerce
Commodity Standards Division

CS9-65	Builders Template Hinges.

Available from Superintendent of Documents, Government Printing Office, Washington D.C. 20402.

SAFETY CODE FOR ELEVATORS
DUMBWAITERS, ESCALATORS AND MOVING WALKS

INTRODUCTION

SECTION 1 — SCOPE

This Code of safety standards covers the design, construction, installation, operation, inspection, testing, maintenance, alteration and repair of elevators, dumbwaiters, escalators, private residence elevators and inclined lifts, moving walks and their hoistways.

Parts I to IX inclusive and Part XIII of this Code apply to the design, construction and installation of only new elevators, dumbwaiters, escalators, moving walks and private residence inclined lifts and their hoistways.

Parts X, XI and XII of this Code apply to the inspection, tests, alterations, replacement of parts of and maintenance of both new and existing installations as specified therein.

The rules of this Code do not apply to the following:

a *Belt, bucket, scoop, roller or similar type conveyors.* (See ANSI B20.1-1957 for Conveyors.)

b *Tiering or piling machines used to move material to and from storage and located and operating entirely within one story.*

c *Equipment for feeding or positioning materials at machine tools, printing presses, etc.*

d *Hoists for raising or lowering materials and which are provided with unguided hooks, slings, and similar means for attachment to the materials.*

e *Skip or furnace hoists.*

f *Wharf ramps.*

g *Amusement devices.*

h *Stage and orchestra lifts.*

i *Lift bridges.*
j *Railroad car lifts or dumpers.*
k *Material hoists and workmen's hoists used to raise and lower building material and workmen in buildings under construction.* (See ANSI A10.2-1944 for material hoists and ANSI A10.4-1963 for workmen's hoists.)
m. *Manlifts.* (See ANSI A90.1-1969.)
n *Devices having a travel of less than one (1) floor, but not exceeding twelve (12) feet and used only for the transfer of material and/or equipment.*
o *Mine elevators.*
p *Hillside inclined lifts.*
q *Mechanized parking garage equipment.* (See ANSI A113.1-1964.)

SECTION 2 — PURPOSE AND EXCEPTIONS

The purpose of this Code is to provide for the safety of life and limb, and to promote the public welfare.

Where a rule because of practical difficulty cannot be complied with literally or where its literal application would cause undue hardship the enforcing authority may upon proper application, grant exceptions, but only when it is clearly evident that reasonable safety is assured.

SECTION 3 — DEFINITIONS

The terms used in the text shall have the following meanings:

Alteration. Any change or addition to the equipment other than ordinary repairs or replacements.

Annunciator, Car. An electrical device in the car which indicates visually the landings at which an elevator landing signal registering device has been actuated.

Approved. Approved by the enforcing authority.

Buffer. A device designed to stop a descending car or counterweight beyond its normal limit of travel by storing or by absorbing and dissipating the kinetic energy of the car or counterweight.

Oil Buffer. A buffer using oil as a medium which absorbs and dissipates the kinetic energy of the descending car or counterweight.

Oil Buffer Stroke. The oil-displacing movement of the buffer plunger or piston, excluding the travel of the buffer-plunger accelerating device.

***Spring Buffer.* A buffer utilizing a spring to cushion the impact force of the descending car or counterweight.

Spring Buffer Load Rating. The load required to compress the spring an amount equal to its stroke.

Spring Buffer Stroke. The distance the contact end of the spring can move under a compressive load until all coils are essentially in contact.

Bumper. A device, other than an oil or spring buffer, designed to stop a descending car or counterweight beyond its normal limit of travel by absorbing the impact.

Car, Elevator. The load-carrying unit including its platform, car frame, enclosure and car door or gate.

Car Door or Gate Electric Contact. An electrical device, the function of which is to prevent operation of the driving machine by the normal operating device unless the car door or gate is in the closed position.

NOTE: This function is subject to the modifications specified in Section 111 of this Code.

Car Door or Gate Power Closer. A device or assembly of devices which closes a manually opened car door or gate by power other than by hand, gravity, springs or the movement of the car.

Car Door or Gate, Power Closed. A door or gate which is closed by a car door or gate power closer or by a door or gate power operator.

Car Enclosure. The top and the walls of the car resting on and attached to the car platform.

Car Frame (Sling). The supporting frame to which the car platform, upper and lower sets of guide shoes, car safety and the hoisting ropes or hoisting-rope sheaves, or the plunger of a direct plunger elevator are attached.

Car Frame, Overslung. A car frame to which the hoisting-rope fastenings or hoisting-rope sheaves are attached to the crosshead or top member of the car frame.

Car Frame, Underslung. A car frame to which the hoisting-rope fastenings or hoisting-rope sheaves are attached at or below the car platform.

Car Frame, Sub-Post. A car frame all of whose members are located below the car platform.

Car Platform. The structure which forms the floor of the car and which directly supports the load.

***Certified.** A certification by a testing laboratory, a professional engineer, a manufacturer or a contractor that a device or an assembly conforms to the requirements of this Code.

Clearance, Bottom Car. The clear vertical distance from the pit floor to the lowest structural or mechanical part, equipment or device installed beneath the car platform, except guide shoes or rollers, safety jaw assemblies and platform aprons or guards, when the car rests on its fully compressed buffers.

Clearance, Top Car. The shortest vertical distance between the top of the car crosshead, or between the top of the car where no crosshead is provided, and the nearest part of the overhead structure or any other obstruction when the car floor is level with the top terminal landing.

Clearance, Top Counterweight. The shortest vertical distance between any part of the counterweight structure and the nearest part of the overhead structure or any other obstruction when the car floor is level with the bottom terminal landing.

Compensating-Rope Sheave Switch. A device which automatically causes the electric power to be removed from the elevator driving-machine motor and brake when the compensating sheave approaches its upper or lower limit of travel.

Control. The system governing the starting, stopping, direction of motion, acceleration, speed and retardation of the moving member.

Control, Generator-Field. A system of control which is accomplished by the use of an individual generator for each elevator or dumbwaiter wherein the voltage applied to the driving-machine motor is adjusted by varying the strength and direction of the generator field.

Control, Multi-Voltage. A system of control which is accomplished by impressing successively on the armature of the driving-machine motor a number of substantially fixed voltages such as may be obtained from multi-commutator generators common to a group of elevators.

Control, Rheostatic. A system of control which is accomplished by varying resistance and/or reactance in the armature and/or field circuit of the driving-machine motor.

Control, Single Speed Alternating Current. A control for a driving-machine induction motor which is arranged to run at a single speed.

Control, Two-Speed Alternating Current. A control for a two-speed driving-machine induction motor which is arranged to run at two different synchronous speeds by connecting the motor windings so as to obtain different numbers of poles.

Controller. A device or group of devices which serves to control in a predetermined manner the apparatus to which it is connected.

Dispatching Device, Elevator Automatic. A device, the principal function of which is to either:

1 Operate a signal in the car to indicate when the car should leave a designated landing, or
2 Actuate its starting mechanism when the car is at a designated landing.

****Door or Gate, Car or Hoistway.** The movable portion of the car or hoistway entrance which closes the opening providing access to the car or to the landing.

Door, Bi-Parting. A vertically sliding or a horizontally sliding door, consisting of two or more sections so arranged that the sections or groups of sections open away from each other and so interconnected that all sections operate simultaneously.

**Door or Gate Closer.* A device which closes a hoistway door or a car door or gate by means of a spring or gravity.

Door or Gate, Power-Operated. A hoistway door or a car door or gate which is opened and closed by a door or gate power operator.

Door or Gate Power-Operator. A device or assembly of devices which opens a hoistway door and/or a car door or gate by power other than by hand, gravity, springs or the movement of the car; and which closes them by power other than by hand, gravity or the movement of the car.

Door or Gate, Self-Closing. A manually opened hoistway door or a car door or gate which closes when released.

Door or Gate, Manually Operated. A door or gate which is opened and closed by hand.

****Dumbwaiter.** A hoisting and lowering mechanism with a car of limited capacity and size which moves in guides in a substantially vertical direction and is used exclusively for carrying material.

***Dumbwaiter, Undercounter Type.* A dumbwaiter which has its top terminal landing located underneath a counter.

Elevator. A hoisting and lowering mechanism equipped with a car or platform which moves in guides in a substantially vertical direction, and which serves two or more floors of a building or structure (see Section 1 of Introduction).

Elevator, Freight. An elevator primarily used for carrying freight and on which only the operator and the persons necessary for unloading and loading the freight are permitted to ride.

NOTE: Its use is subject to the modifications specified in Section 207.

Elevator, Gravity. An elevator utilizing gravity to move the car.

Elevator, Hand. An elevator utilizing manual energy to move the car.

Elevator, Passenger. An elevator used primarily to carry persons other than the operator and persons necessary for loading and unloading.

Elevator, Power. An elevator utilizing energy other than gravitational or manual to move the car.

*******Elevator, Electric.* A power elevator where the energy is applied by means of an electric driving-machine.

Elevator, Hydraulic. A power elevator where the energy is applied, by means of a liquid under pressure, in a cylinder equipped with a plunger or piston.

Elevator, Direct-Plunger. A hydraulic elevator having a plunger or piston directly attached to the car frame or platform.

Elevator, Electro-Hydraulic. A direct-plunger elevator where liquid is pumped under pressure directly into the cylinder by a pump driven by an electric motor.

Elevator, Roped Hydraulic. A hydraulic elevator having its piston connected to the car with wire ropes.

Elevator, Sidewalk. An elevator of the freight type for carrying material exclusive of automobiles and operating between a landing in a sidewalk or other area exterior to a building and floors below the sidewalk or grade level.

Emergency Stop Switch. A device located in the car which, when manually operated, causes the electric power to be removed from the driving-machine motor and brake of an electric elevator or from the electrically operated valves and/or pump motor of a hydraulic elevator.

***Entrance, Elevator and Dumbwaiter.** The protective assembly which closes the hoistway enclosure openings normally used for loading and unloading.

**Entrance, Horizontal Slide Type.* An entrance in which the panel(s) or door(s) slides horizontally.

**Entrance, Swing Type.* An entrance in which the panel(s) or door(s) swings around vertical hinges.

**Entrance, Vertical Slide Type.* An entrance in which the panel(s) or door(s) slides vertically.

Escalator. A power-driven, inclined, continuous stairway used for raising or lowering passengers.

Fire-Resistive Construction. A method of construction which prevents or retards the passage of hot gases or flames as defined by the fire-

resistance rating.

Fire-Resistance Rating. The measured time in hours or fractions thereof that the material or construction will withstand fire exposure as determined by fire tests conducted in conformity to recognized standards.

Gate, Semi-Automatic. A gate which is opened manually and which closes automatically as the car leaves the landing.

Hoistway, Elevator or Dumbwaiter. A shaftway for the travel of one or more elevators or dumbwaiters. It includes the pit and terminates at the underside of the overhead machinery space floor or grating, or at the underside of the roof where the hoistway does not penetrate the roof.

**Blind Hoistway.* The portion of a hoistway which passes floors or other landings at which no normal landing entrances are provided.

Multiple Hoistway. A hoistway for more than one elevator or dumbwaiter.

Single Hoistway. A hoistway for a single elevator or dumbwaiter.

Hoistway Enclosure. The fixed structure, consisting of vertical walls or partitions, which isolates the hoistway from all other parts of the building or from an adjacent hoistway and in which the hoistway doors and door assemblies are installed.

Hoistway Access Switch. A switch, located at a landing, the function of which is to permit operation of the car with the hoistway door at this landing and the car door or gate open, in order to permit access to the top of the car or to the pit.

Hoistway-Door Electric Contact. An electrical device, the function of which is to prevent operation of the driving-machine by the normal operating device unless the hoistway door is in the closed position.

NOTE: This function is subject to the modifications specified in Rule 111.5a of this Code

Hoistway-Door or Gate Locking Device. A device which secures a hoistway door or gate in the closed position and prevents it from being opened from the landing side except under certain specified conditions.

Hoistway-Door Combination Mechanical Lock and Electric Contact. A combination mechanical and electrical device the two related, but entirely independent, functions of which are:

1 To prevent operation of the driving-machine by the normal operating device unless the hoistway door is in the closed position, and
2 To lock the hoistway door in the closed position and prevent it from being opened from the landing side unless the car is within the

landing zone.

NOTES:

a These functions are subject to the modifications specified in Rule 111.4b of this Code.

b As there is no positive mechanical connection between the electric contact and the door-locking mechanism, this device insures only that the door will be closed, but not necessarily locked, when the car leaves the landing. Should the lock mechanism fail to operate as intended when released by a stationary or retiring car-cam device, the door can be opened from the landing side even though the car is not at the landing. If operated by a stationary car-cam device, it does not prevent opening the door from the landing side as the car passes the floor.

Hoistway-Door Interlock. A device having two related and interdependent functions which are:

1 To prevent the operation of the driving-machine by the normal operating device unless the hoistway door is locked in the closed position, and

2 To prevent the opening of the hoistway door from the landing side unless the car is within the landing zone and is either stopped or being stopped.

NOTE: These functions are subject to modifications specified in Rule 111.3a of this Code.

Hoistway-Gate Separate Mechanical Lock. A mechanical device, the function of which is to lock a hoistway gate in the closed position after the car leaves a landing and prevent the gate from being opened from the landing side unless the car is within the landing zone.

Hoistway-Door Interlock Retiring Cam Device. A hoistway-door interlock retiring-cam device is a device which consists of a retractable cam with its actuating mechanism and which is entirely independent of the car-door or hoistway-door power-operator.

Hoistway-Unit System. A series of hoistway-door interlocks, hoistway-door electric contacts or hoistway-door combination mechanical locks and electric contacts, or a combination thereof, the function of which is to prevent operation of the driving machine by the normal operating device unless all hoistway doors are in the closed position and, where so required by this Code, are locked in the closed position.

NOTE: This function is subject to the modifications specified in Rule 111.3a, 111.4b and 111.5a of this Code.

Installation. A complete elevator, dumbwaiter, escalator, private residence inclined lift or moving walk including its hoistway, hoistway enclosures and related construction, and all machinery and equipment necessary for its operation.

Installation, Existing. One for which, prior to the effective date of this code:

1 All work of installation was completed, or

2 The plans and specifications were filed with the enforcing authority and work begun not later than twelve (12) months after the approval of such plans and specifications.

Installation, New. Any installation not classified as an existing installation by definition, or an existing elevator, dumbwaiter, escalator, private residence inclined lift or moving walk moved to a new location subsequent to the effective date of this Code.

Installation Placed Out of Service. An elevator or dumbwaiter whose suspension ropes have been removed, whose car and counterweight rest at the bottom of the hoistway and whose hoistway doors are permanently boarded up or barricaded on the hoistway side or an escalator whose power feed lines have been disconnected and whose top and bottom entrances have been permanently boarded up or barricaded.

Landing, Elevator. That portion of a floor, balcony, or platform used to receive and discharge passengers or freight.

Landing, Bottom Terminal. The lowest landing served by the elevator which is equipped with a hoistway door and hoistway door locking device which permits egress from the hoistway side.

Landing, Top Terminal. The highest landing served by the elevator which is equipped with a hoistway door and hoistway-door locking device which permits egress from the hoistway side.

Landing Zone. A zone extending from a point eighteen inches below a landing to a point eighteen inches above the landing.

Landing, Moving Walk. The stationary area at the entrance to or exit from a moving walk or moving walk system.

Leveling Device, Elevator Car. Any mechanism which will, either automatically or under the control of the operator, move the car within the leveling zone toward the landing only, and automatically stop it at the landing.

NOTES:

1 Where controlled by the operator by means of up-and-down continuous-pressure switches in the car, this device is known as an "inching device."

2 Where used with a hydraulic elevator to correct automatically a change in car level caused by leakage in the hydraulic system, this device is known as an "anti-creep device."

Leveling Device, One-Way Automatic. A device which corrects the car level only in case of under-run of the car, but will not maintain the level during loading and unloading.

Leveling Device, Two-Way Automatic Maintaining. A device which corrects the car level on both under-run and over-run, and maintains the level during loading and unloading.

Leveling Device, Two-Way Automatic Non-Maintaining. A device which corrects the car level on both under-run and over-run, but will not maintain the level during loading and unloading.

Leveling Zone. The limited distance above or below an elevator landing within which the leveling device is permitted to cause movement of the car toward the landing.

Machine, Driving. The power unit which applies the energy necessary to raise and lower an elevator or dumbwaiter car or to drive an escalator, a private residence inclined lift or a moving walk.

Electric Driving Machine. One where the energy is applied by an electric motor. It includes the motor and brake and the driving sheave or drum together with its connecting gearing, belt or chain if any.

Direct-Drive Machine. An electric driving machine the motor of which is directly connected mechanically to the driving sheave, drum, or shaft without the use of belts or chains either with or without intermediate gears.

Geared-Drive Machine. A direct-drive machine in which the energy is transmitted from the motor to the driving sheave, drum, or shaft through gearing.

Traction Machine. A direct-drive machine in which the motion of a car is obtained through friction between the suspension ropes and a traction sheave.

Geared-Traction Machine. A geared-drive traction machine.

Gearless-Traction Machine. A traction machine, without intermediate gearing, which has the traction sheave and the brake drum mounted directly on the motor shaft.

Winding-Drum Machine. A geared-drive machine in which the hoisting ropes are fastened to and wind on a drum.

Worm-Geared Machine. A direct-drive machine in which the energy from the motor is transmitted to the driving sheave or drum through worm gearing.

Indirect-Drive Machine. An electric driving machine, the motor of which is connected indirectly to the driving sheave, drum or shaft by means of a belt or chain through intermediate gears.

Belt-Drive Machine. An indirect-drive machine having a single belt or multiple belts as the connecting means.

Chain-Drive Machine. An indirect-drive machine having a chain as the connecting means.

Hydraulic Driving Machine. One in which the energy is applied by means of a liquid under pressure in a cylinder equipped with a plunger or piston.

Direct-Plunger Driving Machine. One in which the energy is applied by a plunger or piston directly attached to the car frame or platform and which operates in a cylinder under hydraulic pressure. It includes the cylinder and plunger or piston.

Roped-Hydraulic Driving Machine. One in which the energy is applied by a piston, connected to the car with wire ropes, which operates in a cylinder under hydraulic pressure. It includes the cylinder, the piston, and multiplying sheaves if any and their guides.

Screw Machine. An electric driving machine, the motor of which raises and lowers a vertical screw through a nut, with or without suitable gearing, and in which the upper end of the screw is connected directly to the car frame or platform. The machine may be of direct or indirect drive type.

May. The term "may" where used shall be construed as permissive.

Moving Walk. A type of passenger-carrying device on which passengers stand or walk, and in which the passenger-carrying surface remains parallel to its direction of motion and is uninterrupted.

Moving Walk, Belt Type. A moving walk with a power-driven continuous belt treadway.

Moving Walk, Belt Pallet Type. A moving walk with a series of connected and power-driven pallets to which a continuous belt treadway is fastened.

Moving Walk, Pallet Type. A moving walk with a series of connected and power-driven pallets which together constitute the treadway.

Moving Walk, Edge Supported Belt Type. A moving walk with the treadway supported near its edges by a succession of rollers.

Moving Walk, Roller Bed Type. A moving walk with the treadway supported throughout its width by a succession of rollers.

Moving Walk, Slider-Bed Type. A moving walk with the treadway sliding upon a supporting surface.

Moving Walk System. A series of moving walks in end to end or side by side relationship with no landings between treadways.

Non-Stop Switch, Elevator. A switch, which when operated, will prevent the elevator from making registered landing stops.

Operating Device. The car switch, push button, lever or other manual device used to actuate the control.

Operation. The method of actuating the control.

Operation, Automatic. Operation wherein the starting of the elevator car is effected in response to the momentary actuation of

operating devices at the landing, and/or of operating devices in the car identified with the landings, and/or in response to an automatic starting mechanism, and wherein the car is stopped automatically at the landings.

Group Automatic Operation. Automatic operation of two or more non-attendant elevators equipped with power-operated car and hoistway doors. The operation of the cars is coordinated by a supervisory control system including automatic dispatching means whereby selected cars at designated dispatching points automatically close their doors and proceed on their trips in a regulated manner. It includes one button in each car for each floor served and up and down buttons at each landing (single buttons at terminal landings). The stops set up by the momentary actuation of the car buttons are made automatically in succession as a car reaches the corresponding landing irrespective of its direction of travel or the sequence in which the buttons are actuated. The stops set up by the momentary actuation of the landing buttons may be accomplished by any elevator in the group, and are made automatically by the first available car that approaches the landing in the corresponding direction.

Non-Selective Collective Automatic Operation. Automatic operation by means of one button in the car for each landing served and one button at each landing, wherein all stops registered by the momentary actuation of landing or car buttons are made irrespective of the number of buttons actuated or of the sequence in which the buttons are actuated. With this type of operation the car stops at all landings for which buttons have been actuated, making the stops in the order in which the landings are reached after the buttons have been actuated, but irrespective of its direction of travel.

Selective Collective Automatic Operation. Automatic operation by means of one button in the car for each landing served and by up-and-down buttons at the landings, wherein all stops registered by the momentary actuation of the car buttons are made as defined under non-selective collective automatic operation, but wherein the stops registered by the momentary actuation of the landing buttons are made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. With this type of operation, all "up" landing calls are answered when the car is traveling in the up direction and all "down" landing calls are answered when the car is traveling in the down direction, except in the case of the uppermost or lowermost calls which are answered as soon as they are reached irrespective of the direction of travel of the car.

Single Automatic Operation. Automatic operation by means of one button in the car for each landing served and one button at each landing, so arranged that if any car or landing button has been actuated, the actuation of any other car or landing operating button will have no effect on the operation of the car until the response to the first button has been completed.

Operation, Car-Switch. Operation wherein the movement and direction of travel of the car are directly and solely under the control of the operator by means of a manually operated car switch or of continuous-pressure buttons in the car.

Car-Switch Automatic Floor-Stop Operation. Operation in which the stop is initiated by the operator from within the car with a definitive reference to the landing at which it is desired to stop, after which the slowing down and stopping of the elevator is effected automatically.

Operation, Continuous-Pressure. Operation by means of buttons or switches in the car and at the landings, any one of which may be used to control the movement of the car as long as the button or switch is manually maintained in the actuating position.

Operation, Pre-Register. Operation in which signals to stop are registered in advance by buttons in the car and at the landings. At the proper point in the car travel, the operator in the car is notified by a signal, visual, audible, or otherwise, to initiate the stop, after which the landing stop is automatic.

Operation, Signal. Operation by means of single buttons or switches (or both) in the car, and up-or-down direction buttons (or both) at the landings, by which predetermined landing stops may be set up or registered for an elevator or for a group of elevators. The stops set up by the momentary actuation of the car buttons are made automatically in succession as the car reaches those landings, irrespective of its direction of travel or the sequence in which the buttons are actuated. The stops set up by the momentary actuation of the up-and-down buttons at the landing are made automatically by the first available car in the group approaching the landing in the corresponding direction, irrespective of the sequence in which the buttons are actuated. With this type of operation, the car can be started only by means of a starting switch or button in the car.

Overhead Structure. All of the structural members, platforms, etc., supporting the elevator machinery, sheaves and equipment at the top of the hoistway.

Pallet, Moving Walk. One of a series of rigid platforms which together form an articulated treadway or the support for a continuous treadway.

Parking Device, Elevator. An electrical or mechanical device, the function of which is to permit the opening from the landing side of the hoistway door at any landing when the car is within the landing zone of that landing. The device may also be used to close the door.

Pit, Elevator. That portion of a hoistway extending from the threshold level of the lowest landing door to the floor at the bottom of the hoistway.

Position Indicator. A device that indicates the position of the elevator car in the hoistway. It is called a hall position indicator when placed at a landing or a car position indicator when placed in the car.

Private Residence. A separate dwelling or a separate apartment in a multiple dwelling which is occupied only by the members of a single family unit.

***Private Residence Elevator.** A power passenger electric elevator, installed in a private residence, and which has a rated load not in excess of seven hundred (700) pounds, a rated speed not in excess of forty (40) feet per minute, a net inside platform area not in excess of twelve (12) square feet, and a rise not in excess of fifty (50) feet.

Private Residence Inclined Lift. A power passenger lift, installed on a stairway in a private residence, for raising and lowering persons from one floor to another.

Rated Load. The load which the elevator, dumbwaiter, escalator or private residence inclined lift is designed and installed to lift at the rated speed.

Rated Speed. The speed at which the elevator, dumbwaiter, escalator, or inclined lift is designed to operate under the following conditions:

Elevator or Dumbwaiter. The speed in the up direction with rated load in the car.

Escalator or Private Residence Inclined Lift. The rate of travel of the steps or carriage, measured along the angle of inclination, with rated load on the steps or carriage. In the case of a reversible escalator the rated speed shall be the rate of travel of the steps in the up direction, measured along the angle of inclination, with rated load on the steps.

Rope Equalizer, Suspension. A device installed on an elevator car or counterweight to equalize automatically the tensions in the hoisting wire ropes.

Rope-Fastening Device, Auxiliary. A device attached to the car or counterweight or to the overhead dead-end rope-hitch support which will function automatically to support the car or counterweight in case

the regular wire-rope fastening fails at the point of connection to the car or counterweight or at the overhead dead-end hitch.

Runby, Bottom Elevator Car. The distance between the car buffer striker plate and the striking surface of the car buffer when the car floor is level with the bottom terminal landing.

Runby, Bottom Elevator Counterweight. The distance between the counterweight buffer striker plate and the striking surface of the counterweight buffer when the car floor is level with the top terminal landing.

****Runby, Top Direct-Pungler Hydraulic Elevator.** The distance the elevator car can run above its top terminal landing before the plunger strikes its mechanical stop.

****Safety Bulkhead.** A closure at the bottom of the cylinder located above the cylinder head and provided with an orifice for controlling the loss of fluid in the event of cylinder head failure.

Safety, Car or Counterweight. A mechanical device attached to the car frame or to an auxiliary frame, or to the counterweight frame, to stop and hold the car or counterweight in case of predetermined overspeed or free fall, or if the hoisting ropes slacken.

Shall. The term "shall" where used shall be construed as mandatory.

Should. The term "should" where used shall be construed as advisory.

Signal Device, Elevator Car Flash. One providing a signal light in the car, which is illuminated when the car approaches the landings at which a landing signal registering device has been actuated.

Signal Registering Device, Elevator Landing. A button or other device, located at the elevator landing, which when actuated by a waiting passenger, causes a stop signal to be registered in the car.

Signal System, Elevator Separate. One consisting of buttons or other devices located at the landings, which when actuated by a waiting passenger illuminate a flash signal or operate an annunciator in the car indicating floors at which stops are to be made.

Signal Transfer Device, Elevator Automatic. A device by means of which a signal registered in a car is automatically transferred to the next car following, in case the first car passes a floor for which a signal has been registered without making a stop.

Signal Transfer Switch, Elevator. A manually operated switch, located in the car, by means of which the operator can transfer a signal to the next car approaching in the same direction, when he desires to pass a floor at which a signal has been registered in the car.

Slack-Rope Switch. A device which automatically causes the electric

power to be removed from the elevator driving-machine motor and brake when the hoisting ropes of a winding-drum machine become slack.

Slope, Moving Walk. The angle which the treadway makes with the horizontal.

Starters Control Panel, Elevator. An assembly of devices by means of which the starter may control the manner in which an elevator or group of elevators function.

Stopping Device, Elevator Landing. A button or other device, located at an elevator landing, which when actuated, causes the elevator to stop at that floor.

****Terminal Speed Limiting Device, Emergency.** A device which automatically reduces the speed as a car approaches a terminal landing, independently of the functioning of the operating device, and the normal-terminal stopping device if the latter fail to slow down the car as intended.

Terminal Stopping Device, Final. A device which automatically causes the power to be removed from an electric elevator or dumbwaiter driving-machine motor and brake, or from a hydraulic elevator or dumbwaiter machine, independent of the functioning of the normal-terminal stopping device, the operating device or any emergency terminal speed limiting device, after the car has passed a terminal landing.

Terminal Stopping Device, Machine Final (Stop-Motion Switch). A final-terminal stopping device operated directly by the driving machine.

Terminal Stopping Device, Normal. A device or devices to slow down and stop an elevator or dumbwaiter car automatically at or near a terminal landing independently of the functioning of the operating device.

Threshold Comb, Moving Walk. The toothed portion of a threshold plate designed to mesh with a grooved treadway surface.

Threshold Plate, Moving Walk. That portion of the landing adjacent to the treadway consisting of one or more stationary or slightly movable plates.

****Transom.** A panel or panels used to close a hoistway enclosure opening above a hoistway entrance.

Travel (Rise). The vertical distance between the bottom terminal landing and the top terminal landing of an elevator, dumbwaiter, escalator, or a private residence inclined lift.

Traveling Cable. A cable made up of electric conductors, which

provides electrical connection between an elevator or dumbwaiter car and fixed outlet in the hoistway.

Treadway, Moving Walk. The passenger-carrying member of a moving walk.

Truck-Zone, Elevator. The limited distance above an elevator landing within which the truck-zoning device permits movement of the elevator car.

Truck-Zoning Device, Elevator. A device which will permit the operator in the car to move a freight elevator within the truck zone with the car door or gate and a hoistway door open.

Waiting-Passenger Indicator. An indicator which shows at which landings and for which direction elevator hall stop-or-signal calls have been registered and are unanswered.

Weatherproof. So constructed or protected that exposure to the weather will not interfere with its successful operation.

Width, Moving Walk. The width of a moving walk is the exposed width of the treadway.

***Working Pressure.** The pressure measured at the cylinder of a hydraulic elevator when lifting car and its rated load at rated speed, or with Class C2 loading when leveling up with maximum static load.

PART I

**HOISTWAYS, HOISTWAY ENCLOSURES AND RELATED CONSTRUCTION FOR ELECTRIC ELEVATORS

SCOPE

**This part applies to electric elevators.

Many of the rules also apply to hydraulic, sidewalk and hand elevators and to hand and power dumbwaiters as referenced in their respective parts of the Code.

This part does not apply to private residence elevators.

SECTION 100 — CONSTRUCTION OF HOISTWAYS AND HOISTWAY ENCLOSURES

Rule 100.1 Enclosure of Hoistways

100.1a *Fire-Resistive Construction Required.*

Hoistways shall be enclosed throughout their height with fire-resistive enclosures, and all hoistway landing openings shall be protected with fire-resistive door assemblies.

EXCEPTIONS:

(1) Partitions between fire-resistive hoistways and machine rooms having fire-resistive enclosures and which are located at a side of or beneath the hoistway, may be of unperforated non-combustible material at least equal to No. 16 U.S. gage sheet steel in strength and stiffness with openings therein essential for ropes, drums, sheaves and other elevator equipment.

(2) Elevators which are entirely within one story or which pierce no solid floors and serve two or more open galleries, book stacks, etc., in buildings such as powerhouses, libraries, open towers and similar structures.

100.1b* *Fire-Resistance Ratings.*

The fire resistance rating of the hoistway enclosure exclusive of entrances and protective assemblies in other openings shall be not less than two (2) hours as determined by tests conducted in accordance with ANSI A2.1-1970 (ASTM E119-69) Methods of Fire Tests of Building Construction and Materials.

NOTE: Some jurisdictions may consider a rating of less than two (2) hours adequate for some classes of buildings.

The fire resistance ratings of the entrances shall be not less than one and one-half (1½) hours as determined by the tests specified in Section 1102.

The fire resistance rating of hoistway opening protective assemblies other than elevator entrances shall be not less than one and one-half (1½) hours as determined by tests conducted in accordance with ANSI A2.2-1968 (ASTM E152-66) Methods of Fire Tests of Door Assemblies.

100.1c *Non-Fire-Resistive Enclosures.*

Where fire-resistive hoistway enclosures and doors are not required by Rule 100.1a, the hoistway shall be fully enclosed. Enclosures and doors shall be unperforated to a height of six (6) feet above each floor or landing and above the treads of adjacent stairways. Enclosures shall be so supported and braced as to deflect not over one (1) inch when subjected to a force of one hundred (100) pounds applied horizontally at any point. Unperforated-metal enclosures shall be equal to or stronger than No. 18 U.S. gage sheet steel. Openwork enclosures may be used above the six (6) foot level and shall reject a ball two (2) inches in diameter, and shall be either of wire grille at least No. 13 steel wire gage or expanded metal at least No. 13 U.S. gage.

100.1d *Multiple Hoistways.*

Where four (4) or more elevators serve all or the same portion of a building, they shall be located in not less than two (2) hoistways, but in no case shall more than four (4) elevators be located in any one hoistway.

100.1e *Strength of Enclosure.*

The hoistway enclosure adjacent to a landing opening shall be of sufficient strength to support in true alignment the hoistway doors with their operating mechanism and locking devices.

Rule 100.2 Construction at Top and Bottom of Hoistway

100.2a *Hoistways Extending into the Top Floor.*

Where a hoistway extends into the top floor of a building, fire-resistive hoistway or machinery-space enclosures, where required, shall be carried to the underside of the roof if the roof is of fire-resistive construction, and at least three (3) feet above the top surface of the roof if the roof is of non-fire-resistive construction.

100.2b *Hoistways Terminating Below the Top Floor.*

Where a hoistway does not extend into the top floor of a building, the top of the hoistway shall be enclosed with fire-resistive construction having a fire-resistance rating at least equal to that required for the hoistway enclosures.

100.2c *Construction at Bottom of Hoistway.*

Pits extending to the ground shall have non-combustible floors and shall be so designed as to prevent entry of ground water into the pit. The pit floor of any hoistway not extending to the ground shall be of fire-resistive construction having a fire-resistance rating at least equal to that required for the hoistway enclosure (See Rule 109.1(c)).

EXCEPTION: Except as provided in Exception 1 of Rule 100.1a.

Rule 100.3 Floor Over Hoistways

100.3a *Where Required.*

A metal or concrete floor shall be provided at the top of the hoistway.

EXCEPTIONS: Floors are not required below:

(1) Secondary and deflecting sheaves of traction-type machines located over the hoistway.

(2) Overhead sheaves, governors and other equipment where the elevator machine is located below or at the side of the hoistway, provided that:

(a) Means of access for inspection and servicing of governors is provided from outside the hoistway, conforming to the requirements of Rule 101.3c.

(b) Sheaves and other equipment (except governors) may be inspected and serviced from the top of the car, or means of access from outside the hoistway may be provided conforming to the requirements of Rule 101.3c.

100.3b *Location of Floor.*

The floor shall be located:

1 Above or level with the top of the machine beams where the machine is located over the hoistway.

2 Below the overhead sheaves where the machine is not located over the hoistway.

100.3c *Strength of Floor.*

The floor shall be capable of sustaining a concentrated load of three hundred (300) pounds on any four (4) square inches; and where it constitutes the floor of the main or secondary-level machinery space, it shall be designed for a live load of not less than one hundred and twenty-five (125) pounds per square foot in all open areas.

A sign stating the maximum allowable load for which the floor is designed shall be prominently displayed in all main and secondary machine-room spaces. The sign shall be of metal with black letters and figures at least four (4) inches high on a white background.

Where the elevator machine is to be supported solely by the machine-room floor slab, the floor slab shall be designed in accordance with the requirements of Rules 105.4 and 105.5.

100.3d *Construction of Floors.*

Floors may be of concrete, or may be of metal construction with or without perforations. Metal floors shall conform to the following:

1 If of bar-type grating, the openings between bars shall reject a ball three-quarters (¾) of an inch in diameter.
2 If of perforated sheet metal or of fabricated openwork construction, the openings shall reject a ball one (1) inch in diameter.

100.3e* *Area to be Covered by Floor.*

The floor shall extend over the entire area of the hoistway where the cross-sectional area is one hundred (100) square feet or less. Where the cross-sectional area is greater, the floor shall extend not less than two (2) feet beyond the general contour of the machine or sheaves or other equipment, and to the entrance to the machinery space at or above the level of the platform.

Where the floor does not cover the entire horizontal area of the hoistway, the open or exposed sides shall be provided with a standard railing not less than forty-two (42) inches high and a toe board not less than four (4) inches high, conforming to the requirements of American Standard Safety Code for Floor and Wall Openings, Railings and Toe Boards, ANSI A12.1-1967.

100.3f* *Difference in Floor Levels.*

Differences in levels of machine-room and machinery-space floors shall be avoided where practicable. Where there is a difference in level in such floors exceeding fifteen (15) inches, a railing at least forty-two (42) inches high shall be provided at the edge of the higher level where such change in level occurs, and stairs or ladders shall be provided for access between levels. Railings shall conform to the requirements of ANSI A12.1-1967.

Rule 100.4 Venting of Hoistways

100.4a* *Vents Required.*

Hoistways of elevators serving more than three (3) floors shall be provided with means for venting smoke and hot gases to the outer air in case of fire.

EXCEPTIONS: Hoistways not extending into the top floor of the building, in buildings other than hotels, apartment houses, hospitals and similar buildings with overnight sleeping quarters, where the hoistways are equipped with approved automatic sprinklers connected to the building water-supply system or to an approved automatic sprinkler system (See NFPA No. 13-1969 Sprinkler System). Such systems shall be responsive to an accumulation of smoke as well as heat at the top of the hoistway.*

100.4b* *Location of Vents.*

Vents shall be located:

1 In the side of the hoistway enclosure directly below the floor or floors at the top of the hoistway, and shall open either directly to the outer air or through noncombustible ducts to the outer air; or

2 In the wall or roof of the penthouse or overhead machinery space above the roof, provided that openings have a total area not less than the minimum specified in Rule 100.4c.

100.4c *Area of Vents.*

The area of the vents shall be not less than three and one-half (3½) percent of the area of the hoistway nor less than three (3) square feet for each elevator car, whichever is greater. Of the total required vent area, not less than one-third (1/3) shall be permanently open or automatically opened by a damper.

NOTE: A hinged damper which will open under a small amount of pressure is considered a permanently open vent.

EXCEPTIONS: Where mechanical ventilation providing equivalent venting of the hoistway is provided, the required vent area may be reduced subject to the following: (1) The building is not a hotel, apartment house, hospital or similar building with overnight sleeping quarters.

(2) The hoistway or machine room is so located that it has no outside exposure.

(3) The hoistway does not extend to the top of the building.

(4) The hoistway or machine room exhaust fan is automatically reactivated by thermostatic means.

100.4d *Closed Vents.*

Closed portions of the required vent area shall consist of windows, skylights or duct openings glazed with plain glass not more than one-eighth (⅛) inch thick.

100.4e *Window and Skylight Frames and Sash.*

Window and skylight frames and sash shall be of metal.

100.4f *Skylight Guards.*

A guard securely anchored to the supporting structure, consisting of a wire-mesh screen of at least No. 13 steel wire gage with openings which will reject a ball one (1) inch in diameter, or an expanded metal screen of equivalent strength and open area, shall be installed above every elevator skylight. A similar screen of at least No. 18 steel wire gage, or of expanded metal of equivalent strength and open area, shall be installed below every elevator skylight.

Rule 100.5 Windows in Hoistway Enclosures**

Windows in the walls of hoistway enclosures are prohibited.

Rule 100.6 Projections, Recesses and Setbacks in Hoistway Enclosures

Hoistway enclosures shall have substantially flush surfaces on the hoistway side subject to the following:

a *On sides for Loading and Unloading.* Landing sills, hoistway doors door tracks and hangers may project inside the general line of the hoistway. Sills shall be guarded as required by Rule 110.10a.

b *On Sides Not Used for Loading and Unloading.* Recesses except those necessary for installation of elevator equipment shall not be permitted. Beams, floor slabs or other building construction shall not project more than two (2) inches inside the general line of the hoistway unless the top surface of the projection is beveled at an angle of not less than seventy-five (75) degrees with the horizontal. Where setbacks occur in the enclosure wall, the top of the setback shall be beveled at an angle of not less than seventy-five (75) degrees with the horizontal. Separator beams between adjacent elevators are not required to have bevels.

SECTION 101 — MACHINE ROOMS AND MACHINERY SPACES

Rule 101.1 Enclosure of Machine Rooms and Machinery Spaces

101.1a* *Enclosures Required for Elevators Having Fire-Resistive Hoistway Enclosures.*

Spaces containing machines, control equipment, sheaves and other machinery shall be enclosed with fire-resistive enclosures. Enclosures and access doors thereto shall have a fire-resistance rating at least equal to that required for the hoistway enclosure.

EXCEPTIONS:

(1) Partitions between elevator machine rooms and fire-resistive hoistway (See Rule 100.1a, Exception 1).

(2) Screw machines may be installed inside the hoistway without additional enclosures provided that the control equipment shall be located outside the hoistway.

(3) Enclosures located above the roof level may be of the openwork type. Such enclosures shall reject a ball two (2) inches in diameter and shall be of noncombustible material.

NOTE: See Rule 100.3 for floors of machine rooms and machinery spaces.

101.1b* *Enclosures Required for Elevators Having Non-Fire-Resistive Hoistway Enclosures.*

Spaces containing machines, control equipment, sheaves and other machinery shall be enclosed in enclosures of noncombustible material not less than six (6) feet high. If of openwork material, the enclosure shall reject a ball two (2) inches in diameter.

Rule 101.2 Equipment in Machine Rooms

101.2a *Equipment Permitted in Machinery and Control Spaces.*

Where the elevator machine and control equipment are located at the top of the hoistway, they may be located in a room or space containing other machinery and equipment essential to the operation of the building; provided that they are separated from the other machinery or equipment by a substantial metal grille enclosure not less than six (6) feet high with a self-closing and self-locking door. The grille enclosure shall be of a design which will reject a ball two (2) inches in diameter.

101.2b *Equipment Prohibited in Machine Room.*

Where the elevator machine and control equipment are not located at the top of the hoistway, only machinery and equipment required for the operation of the elevator shall be permitted in the elevator machine room.

Rule 101.3 Access to Machine Rooms and Machinery Spaces

101.3a *General Requirements.*

A permanent, safe and convenient means of access to elevator machine rooms and overhead machinery spaces shall be provided for authorized persons.

101.3b* *Access Across Roofs.*

Where passage over roofs is necessary to reach the means of access to machine rooms or machinery spaces, the following requirements shall be conformed to:

1** A stairway with a swing door and platform at the top level, conforming to the requirements of Rule 101.3c shall be provided from the top floor of the building to the roof level.

2* Where the passage is over a sloping roof having a slope exceeding fifteen (15) degrees from the horizontal, an unobstructed, permanent and substantial walkway not less than twenty-four (24) inches wide, equipped on at least one side with a standard railing not less than forty-two (42) inches high, shall be provided from the building exit door at the roof level to the means of access to the machine room or machinery spaces. Railings shall conform to the requirements of the Safety Code for Floors and Wall Openings, Railings and Toe Boards, ANSI A12.1-1967.

101.3c *Requirements for Means of Access.*

The means of access to machine rooms, to machinery spaces, and to different floor levels in machine rooms shall conform to the following:

1 Where the floor of the machine room or of the machinery space,

or where the distance between machine-room floor levels, is more than eight (8) inches above or below the floor or roof from which the means of access leads, metal stairs or ladders shall be provided between such levels.

2 Where the difference in level is not more than three (3) feet, a vertical ladder with hand-grips may be provided.

3 Except as provided in subdivision 2 of this rule, stairs having a maximum angle of sixty (60) degrees from the horizontal shall be provided, and shall be equipped with a metal handrail on all open sides.

EXCEPTION: Vertical ladders with hand grips may be used where the difference in level is more than three (3) feet for access from building floors or machine rooms to machinery spaces containing overhead sheaves, secondary and deflecting sheaves, governors and auxiliary equipment not including controllers and motor generators.

4* A metal or concrete platform shall be provided at the top of the stairs with metal railings on each open side. The size of the platform shall be sufficient to permit the full swing of the door plus two (2) feet from the top of the riser to the swing line of the door. The floor of the platform shall be at the level of or not more than eight (8) inches below the level of the access-door sill. Where the door swings inward, the width of the platform shall be not less than two (2) feet six (6) inches, and the length not less than the width of the door.

5* Handrails and railings shall conform to the Safety Code for Floors and Wall Openings, Railings and Toe Boards, ANSI A12.1-1967.

101.3d* *Access Doors.*

Access doors to machine rooms and overhead machinery spaces shall:

1 Have a minimum width of two (2) feet six (6) inches and a minimum height of six (6) feet for machine rooms and two (2) feet six (6) inches for other spaces specified in Rule 101.4, second paragraph subdivisions b and c.

2 Be self-closing.

3 Be provided with a spring-type lock arranged to permit the doors to open from inside without a key.

4 Be kept closed and locked except during periods when an attendant is on duty in the room or space.

EXCEPTION: Doors are not required at openings in machine-room floors for access to deflecting and secondary-sheave spaces provided the access opening is provided on all four sides with a railing not less than forty-two (42) inches high, one side of which is arranged to slide or swing to provide access to the ladder or stairs leading to the secondary-sheave space. Trap doors, where provided, shall have railing or guard wings on all open sides.

Rule 101.4 Head Room in Machine Rooms and Overhead Machinery Spaces

Elevator machine rooms and machinery spaces not located over the hoistway shall have a head room of not less than seven (7) feet zero (0) inches.

Where a floor is provided at the top of the hoistway (See Rule 100.3), elevator machine rooms and overhead machinery spaces above such floor shall have a clear head room of not less than the following:

a Machine, control and motor-generator rooms, seven (7) feet zero (0) inches.

b Spaces containing only overhead, secondary or deflecting sheaves, three (3) feet six (6) inches.

c Spaces containing overhead, secondary or deflecting sheaves, and governors, signal machines or other equipment, four (4) feet six (6) inches.

Where floors are provided under secondary and deflecting sheaves, the machine and supporting beams may encroach on the required head room provided there is a clearance of not less than three (3) feet between the underside of such beams and the top of the floor.

Rule 101.5 Lighting and Ventilation of Machine Rooms and Machinery Spaces

101.5a *Lighting.*

Permanent electric lighting shall be provided in all machine rooms and machinery spaces.

The illumination shall be not less than ten (10) foot candles at the floor level. The lighting control switch shall be located within easy reach of the access to such rooms or spaces. Where practicable, the light control switch shall be located on the lock-jamb side of the access door.

101.5b *Ventilation for Machinery and Control Equipment.*

Machine rooms shall be provided with natural or mechanical ventilation to avoid overheating of the electrical equipment and to insure safe and normal operation of the elevator.

Rule 101.6 Storage of Materials in Machine and Control Room

Elevator machine and control rooms shall be maintained free of refuse, and shall not be used for the storage of articles or materials unnecessary for the maintenance or operation of the elevator. Flammable liquids having a flash point of less than one hundred and ten (110) degrees F shall not be kept in such rooms.

SECTION 102 — ELECTRICAL WIRING, PIPES AND DUCTS IN HOISTWAYS AND MACHINE ROOMS

Rule 102.1 Installation of Raceways and Wiring in Hoistway and Machine Rooms

102.1a* *Wiring, Raceways and Cables in Hoistways.*

Main feeders for supplying power to the elevator shall be installed outside the hoistway.

Only such electrical wiring, raceways and cables used directly in connection with the elevator, including wiring for signals, for communication with the car, for lighting, heating, air conditioning and ventilating the car, and wiring for low-voltage fire-detecting systems, pit sump pumps, and for heating and lighting the hoistway, may be installed inside the hoistway. The surface temperature of electrical heaters used for heating the hoistway shall not exceed six hundred (600) degrees F.

102.1b *Method of Installation of Wiring in Hoistways.*

Stationary electrical conductors located in hoistways shall be encased in rigid metal conduits or electrical metallic tubing or metal wireways.

EXCEPTION: Flexible conduit or armored cables may be used between hoistway risers and limit switches, hoistway-door interlocks or contacts, and signal or stop buttons and similar devices.

All conduits, armored cables, electrical metallic tubing, metal wireways and flexible conduits, carrying electrical conductors located within hoistways, shall be securely fastened to the hoistway construction or to the guide rails or to the guide-rail supports.

102.1c* *Wiring Methods in Hoistways and Machine Rooms.*

The installation of all electrical wiring in hoistways and machine rooms, except as may be provided elsewhere in these rules, shall conform to the requirements of the National Electrical Code, ANSI C1-1968 (NFPA 70-1968).

The flexible traveling cables, connecting the elevator car to the stationary hoistway wiring, shall be provided with a flame-retardant and moisture-resistant outer cover.

102.1d *Enclosure of Live Parts on Cars and in Hoistways.*

All live parts of electrical apparatus, located in or on elevator cars or in their hoistways, shall be suitably enclosed to protect against accidental contact.

The maximum circuit voltage of control or operating circuits permitted in or on elevator cars and their hoistways shall not exceed that specified in Rule 210.3a.

Rule 102.2* Installation of Pipes or Ducts Conveying Gases, Vapors or Liquids in any Hoistway, Machine Room or Machinery Space.

Pipes or ducts conveying gases, vapors or liquids and not used in connection with the operation of the elevator shall not be installed in any hoistway, machine room or machinery space.

EXCEPTIONS:

(1) Steam and hot water pipes may be installed in hoistways, machine rooms and machinery spaces for the purpose of heating these areas only, subject to the following:

(a) Heating pipes shall convey only low pressure steam (five (5) pounds per square inch or less) or hot water (two hundred and twelve (212) degrees F or less).

(b) All risers and return pipes shall be located outside the hoistway.

(c) Traps and shut-off valves shall be provided in accessible locations outside the hoistway.

(2) Ducts for heating, cooling, ventilating and venting may be installed in the machine room and machinery space.

(3) Pipes for sprinklers only may be installed in these spaces subject to the following:*

(a) All risers and returns shall be located outside these spaces.

(b) Branch lines in hoistway shall supply sprinklers at not more than one floor level.

(c) Shut-off valves shall be provided in accessible locations outside these spaces.

(4) Piping for pit and sump pumps may be installed.*

SECTION 103 — LOCATION AND GUARDING OF COUNTERWEIGHTS

Rule 103.1 Location of Counterweights

Counterweights shall be located only in the hoistway of the elevator which they serve.

Rule 103.2 Counterweight Pit Guards

103.2a *Where Required.*

Unperforated metal guards shall be installed in the pit on the open side or sides of all counterweights where spring or solid-type buffers are used or where oil buffers attached to the counterweight are used.

EXCEPTION: Where compensating chains or ropes are attached to the counterweight, the guard may be omitted on the side facing the elevator car to which the chains or ropes are attached.

103.2b* *Design, Construction and Location of Guards.*

Guards shall extend from a point not more than twelve (12) inches above the pit floor to a point not less than seven (7) feet nor more than eight (8) feet above such floor, and shall be fastened to a metal frame properly reinforced and braced to be at least equal in strength and stiffness to No. 14 U.S. gage sheet steel.

SECTION 104 — GUARDING OF EXPOSED EQUIPMENT

Rule 104.1 Where Required

Exposed gears, sprockets, tape or rope sheaves or drums of selectors, floor controllers or signal machines, and the ropes, chains or tapes for driving same, in machine rooms and secondary machinery spaces, shall be guarded to protect against accidental contact.

SECTION 105 — MACHINERY AND SHEAVE BEAMS, SUPPORTS AND FOUNDATIONS

Rule 105.1 Beams and Supports Required

Machines, machinery and sheaves shall be so supported and maintained in place as to effectually prevent any part from becoming loose or displaced under the conditions imposed in service.

Supporting beams, if used, shall be of steel or reinforced concrete. Beams are not required under machines, sheaves, and machinery or control equipment which are supported on floors provided such floors are designed and installed to support the load imposed thereon.

Rule 105.2 Loads on Machinery and Sheave Beams, Floors or Foundations and Their Supports

105.2a *Overhead Beams, Floors and Their Supports.*

Overhead beams, floors and their supports shall be designed for not less than the sum of the following loads:

1 The load resting on the beams and supports which shall include the complete weight of the machine, sheaves, controller, governor and any other equipment together with that portion, if any, of the machine-room floor supported thereon.

2 Two (2) times the sum of the tensions in all wire ropes passing over sheaves or drums supported by the beams with rated load in the car.

NOTE: These tensions are doubled to take care of impact, accelerating stresses, etc.

105.2b *Foundations, Beams and Floors for Machinery and Sheaves Not Located Directly Over the Hoistway.*

For machines and sheaves located below or at the sides of the hoistway, the foundation for the machine and sheave beams and their supports shall be designed to withstand the following loads:

1 The foundation shall support the total weight of the machine, sheaves and other equipment, and the floor if any.

2 The sheave beams and the foundation bolts shall withstand two (2) times the vertical component of the tensions in all hoisting ropes passing over sheaves or drums on the foundation or beams, less the weight of the machine or sheaves.
3 The sheave beams and the foundation bolts shall withstand two (2) times the horizontal component, if any, of the tensions in all hoisting ropes passing over sheaves or drums on the foundation or beams.
4 The foundation shall withstand two (2) times the overturning moment, if any, developed by the tensions in all the hoisting ropes passing over sheaves or drums on the foundations or beams.

Rule 105.3 Securing of Machinery and Equipment to Beams, Foundations or Floors

105.3a *Overhead Beams and Floors.*

Machinery or equipment shall be secured to and supported on or from the top of overhead beams or floors.

EXCEPTIONS:
(1) Secondary or deflecting sheaves of traction elevator.
(2) Devices and their accessories for limiting or retarding car speed.
(3) Securing bolts or fastenings are not required where sound isolation is used between bases of machinery or equipment and supporting beams or floors.

105.3b** *Beams or Foundations Supporting Machinery and Sheaves Not Located Directly Over the Hoistway.*

Machines and sheaves located below or at one side of a hoistway shall be anchored to beams, foundations or floors with bolts, conforming to ASTM Specification A307-67, of sufficient size and number to withstand the applicable load conditions specified in Rule 105.2b. Based on these initial loads, total tension in anchor bolts shall not exceed twelve thousand (12,000) pounds per square inch of net section, and the total shear shall not exceed eight thousand six hundred (8,600) pounds per square inch of actual area in the shear plane. Where bolts are used through greater than five (5) degrees sloping flanges of structural shapes, the boltheads shall be of the tipped or beveled-head type or shall be fitted with beveled steel washers, and nuts on greater than five (5) degrees sloping flanges shall seat on beveled steel washers.

EXCEPTION: Bolts made of steel having a greater strength than specified by ASTM Specification A307-67 may be used and the maximum allowable stresses increased proportionally based on the ratio of the ultimate strengths. Elongation must conform to the requirements of the corresponding ASTM specification.

105.3c* *Overhead Hoisting Rope Hitches.*

Where hoisting ropes are secured to the structure above a hoistway, the hitch plates and hitch-plate blocking beams where used shall be secured to and mounted on top of overhead beams, machine beams, or

on top of auxiliary beams connected to the webs of overhead beams. Hitch plates, blocking or auxiliary beams shall be secured by bolting, riveting or welding and shall be so located that the tension in the hoisting ropes will not develop direct tensions in the bolts or rivets. Bolts and rivets shall conform to ASTM Specifications A307-67 and A502-65, respectively. Welding shall conform to Rule 203.7c. Where bolts and rivets are subjected to shearing stresses due to tension in the hoisting ropes, the total shear shall not exceed eight thousand six hundred (8,600) pounds per square inch of actual area in the shear plane. The stresses in welds due to tensions in the hoisting ropes shall not exceed eight thousand (8,000) pounds per square inch on the throat area of the welds.

The hitch-plate supporting beams shall be designed to withstand two (2) times the sum of the tensions in all hoisting ropes attached to the hitch plates.

Total stresses in tension plus bending in hitch-plate and hitch-plate shapes shall not exceed twelve thousand (12,000) pounds per square inch.

EXCEPTION: Bolts made of steel having a greater strength than specified by ASTM Specification A307-67 may be used and the maximum allowable stresses increased proportionally based on the ratio of the ultimate strengths. Elongation must conform to the requirements of the corresponding ASTM specification.*

105.3d *Cast Metals in Tension or Bending.*

Cast metals having an elongation of less than twenty (20) percent in a length of two (2) inches, which are subject to tension or bending, shall not be used to support machinery or equipment from the underside of overhead beams or floors.

Rule 105.4 Allowable Stresses for Machinery and Sheave Beams or Floors and Their Supports

The unit stresses for all machinery and sheave beams and floors and their supports, based on the loads computed as specified in Rule 105.2, shall not exceed eighty (80) percent of those permitted for static loads by the following codes:

a Structural Steel. AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, 1963.

b* Reinforced Concrete. Building Code Requirements for Reinforced Concrete, ANSI A89.1-1964 (ACI 318-63).

Where stresses due to loads, other than elevator loads, supported on the beams or floor exceed those due to the elevator loads, one hundred (100) percent of the permitted stresses may be used.

Rule 105.5 Allowable Deflections of Machinery and Sheave Beams and Their Supports

The allowable deflections of machinery and sheave beams and their immediate supports under static load, shall not exceed 1/1666 of the span.

SECTION 106 — PITS

Rule 106.1 Pits

106.1a *Where Required.*

A pit shall be provided for every elevator.

106.1b *Design and Construction of Pits.*

The construction of the pit walls, the pit floor and any pit access doors (See Rule 106.1d) shall conform to Rules 100.1 and 100.2.

The floor of the pit shall be approximately level.

EXCEPTIONS:

(1) Trenches or depressions may be provided for the installation of buffers, compensating sheaves and frames, and vertically-sliding biparting hoistway doors where structural conditions make such trenches or depressions necessary.

(2) Where new elevators are installed or existing elevators are altered in existing buildings, existing foundation footings extending above the general level of the pit floor may remain in place provided the maximum encroachment of such footings does not exceed fifteen (15) percent of the cubic content of the pit and further provided that it is impracticable to remove the footing.

Drains connected directly to sewers shall not be installed in elevator pits.

EXCEPTION: Sumps with or without pumps may be installed.

106.1c *Guards Between Adjacent Pits.*

Where there is a difference in level between the floors of adjacent pits, a guard of unperforated metal, or a perforated metal guard having openings which will reject a ball two (2) inches in diameter shall be installed for separating such pits. Guards shall extend not less than six (6) feet above the level of the higher pit floor and may be provided with a self-closing access door.

EXCEPTION: Where the difference in level is two (2) feet or less, a metal railing not less than forty-two (42) inches high measured from the level of the higher pit floor may be installed in lieu of the guard.

106.1d *Access to Pits.*

Safe and convenient access shall be provided to all pits, and shall conform to the following:

1 Access may be by means of the lowest hoistway door or by means of a separate pit access door.

2 Access to pits extending more than four (4) feet below the sill of the pit access door shall be provided by means of fixed vertical ladders of noncombustible material, located within reach of the access door. The ladder shall extend not less than thirty (30) inches above the sill of the access door, or hand-grips shall be provided to the same height. Access to pits of elevators in multiple hoistways may be by means of a single hoistway door and ladder.

3 Pits shall be accessible only to authorized persons.

Where a separate pit access door is provided, it shall be self-closing and provided with a spring-type lock arranged to permit the door to be opened from inside the pit without a key. Such doors shall be kept locked.

106.1e *Illumination of Pits.*

A permanent lighting fixture shall be provided in all pits, which shall provide an illumination of not less than five (5) foot candles at the pit floor. A light switch shall be provided and shall be so located as to be accessible from the pit access door.

106.1f *Stop Switch in Pits.*

There shall be installed in the pit of every elevator an enclosed stop switch meeting the requirements of Rule 210.2-e.

This switch shall be so located as to be accessible from the pit access door. Where access to the pits of elevators in a multiple hoistway is by means of a single access door, the stop switch for each elevator shall be located adjacent to the nearest point of access to its pit from the access door.

106.1g *Minimum Pit Depths Required.*

The pit depth shall be not less than is required for the installation of the buffers, compensating sheaves if any, and all other elevator equipment located therein, and to provide the minimum bottom clearance and runby required by Rule 107.1.

SECTION 107 — BOTTOM AND TOP CLEARANCES AND RUNBYS FOR ELEVATOR CARS AND COUNTERWEIGHTS

Rule 107.1 Clearances

107.1a *Bottom Car Clearances.*

When the car rests on its fully compressed buffer, there shall be a vertical clearance of not less than two (2) feet between the pit floor and the lowest structural or mechanical part, equipment or device installed beneath the car platform except guide shoes or rollers, safety-jaw assemblies and platform aprons, guards or other equipment located within

twelve (12) inches horizontally from the sides of the car platform (see Figure B4, Appendix B).

Trenches and depressions or foundation encroachments permitted by Rule 106.1b shall not be considered in determining this clearance.

When the car rests on its fully compressed buffer, no part of the car or any equipment attached thereto shall strike any part of the pit or any part of the equipment located therein.

107.1b *Bottom Runby for Counterweighted Elevators.*

The bottom runby of cars and counterweights shall be not less than the following:

1 Where oil buffers are used, six (6) inches.

EXCEPTIONS:

(1) Where practical difficulties prevent a sufficient pit depth or where a top clearance cannot be provided to obtain the runby specified, it may be reduced.

(2) Where spring-return type oil buffers are used, the runby may be eliminated so that the buffers are compressed by amounts not exceeding those permitted by Rule 201.4h, when the car floor is level with the terminal landings.

2 Where spring buffers are used:

a Six (6) inches where generator-field control is used.

b Where rheostatic control is used, not less than the following:

Rated Speed in Feet Per Minute	Runby in Inches
Not over 25	3
26 to 50	6
51 to 100	9
101 to 200	12

107.1c *Bottom Runby for Uncounterweighted Elevators.*

The bottom runby of uncounterweighted elevators shall be not less than the following:

1 Three (3) inches where the rated speed does not exceed twenty-five (25) feet per minute.

2 Six (6) inches where the rated speed exceeds twenty-five (25) feet per minute.

107.1d *Maximum Bottom Runby.*

In no case shall the maximum bottom runby exceed the following:

1 Twenty-four (24) inches for cars.

2 Thirty-six (36) inches for counterweights.

107.1e *Top Car Clearances for Counterweighted Elevators.*

The top car clearance shall be not less than the sum of the following four items:

1 The bottom counterweight runby.
2 The stroke of the counterweight buffer used.
3 Two (2) feet or the distance which any sheave or any other equipment mounted in or on the car crosshead projects above the top of the car crosshead, whichever is greater.
4 Where an oil buffer is used for the counterweight and no provision is made to prevent the jump of the car at counterweight buffer engagement, add
  a One-half (½) the gravity stopping distance, (See Section 1304) based on one hundred and fifteen (115) percent of rated speed, or
  b One-half (½) the counterweight buffer stroke if a reduced stroke buffer conforming to Rule 201.4a-2 is used.

  Where counterweight spring buffers are used, add one-half (½) the gravity stopping distance (Section 1304) based on governor tripping speed.

EXCEPTION: Subdivisions 1 and 2 of this rule may be modified correspondingly when the bottom counterweight runby has been reduced or eliminated as provided in Rule 107.1b(1).

107.1f *Top Car Clearance for Uncounterweighted Elevators.*

The top car clearance shall be not less than the greater of the following:
1 Two (2) feet, six (6) inches.
2 Six (6) inches plus the amount which any equipment mounted on the car crosshead, or above the car top when no crosshead is provided, projects vertically more than two (2) feet above the crosshead or top.

107.1g *Vertical Clearances with Underslung Car Frames.*

Where an underslung car frame is used, the clearances between the car rope hitches or car sheaves and any obstruction in the hoistway vertically above them, when the car floor is level with the top terminal landing, shall be not less than the following:
1 Where no counterweight is used, nine (9) inches.
2 Where a counterweight is used, the sum of the following items:
  a The bottom counterweight runby.
  b The stroke of the counterweight buffer used.
  c Six (6) inches.
  d Where an oil buffer is used for the counterweight and no provision is made to prevent the jump of the car at counterweight buffer engagement, add:
    1 One-half (½) the gravity stopping distance (See Section 1304) based on one hundred and fifteen (115) percent of rated speed, or

2 One-half (½) the counterweight buffer stroke if a reduced stroke buffer conforming to Rule 201.4a is used.

Where counterweight spring buffers are used, add one-half (½) the gravity stopping distance (See Section 1304) based on governor tripping speed.

EXCEPTION: Subdivisions 2a and 2b of this rule may be modified correspondingly where the bottom counterweight runby has been reduced or eliminated as provided in Rule 107.1b(1).

107.1h *Top Counterweight Clearances.*

The top counterweight clearance shall be not less than the sum of the following four items:

1 The bottom car runby.
2 The stroke of the car buffer used.
3 Six (6) inches.
4 Where an oil buffer is used for the car and no provision is made to prevent the jump of the counterweight at car buffer engagement, add:
   a One-half (½) the gravity stopping distance (see Section 1304) based on one hundred and fifteen (115) percent of rated speed, or
   b One-half (½) the car buffer stroke if a reduced stroke buffer conforming to Rule 201.4a-2 is used.

Where car spring buffers are used, add one-half (½) the gravity stopping distance (see Section 1304) based on governor tripping speed.

EXCEPTION: Subdivisions 1 and 2 of this rule may be modified correspondingly when the bottom car runby has been reduced or eliminated as provided in Rule 107.1b(1).

107.1i *Overhead Clearances Where Overhead Beams Are Not Over Car Crosshead.*

Where overhead beams or other overhead hoistway construction except sheaves are located vertically over the car, but not over the crosshead, the following requirements shall be met:

1 The clearance from the car top to such beams or construction, when the car is level with the top landing, shall be not less than the amount specified in Rules 107.1e and 107.1f.
2 Such beams or construction shall be located not less than two (2) feet horizontally from the crosshead.

107.1j *Equipment on Top of Car Not Permitted to Strike Overhead Structure.*

When the car crosshead or car top where no crosshead is provided is at a distance equal to that specified in Rule 107.1e, Subdivision 3, from the nearest obstruction above it, no equipment on top of the car shall strike any part of the overhead structure or the equipment located in the hoistway.

SECTION 108 — HORIZONTAL CAR AND COUNTERWEIGHT CLEARANCES

Rule 108.1 Clearances Between Cars, Counterweights and Hoistway Enclosures

108.1a *Between Car and Hoistway Enclosures.*

The clearance between the car and the hoistway enclosure shall be not less than three-quarters (¾) inch except on the sides used for loading and unloading.

108.1b *Between Car and Counterweight and Counterweight Screen.*

The clearance between the car and the counterweight shall be not less than one (1) inch. The clearance between counterweight and the counterweight screen and between the counterweight and the hoistway enclosure shall be not less than three-quarters (¾) inch.

108.1c *Between Cars in Multiple Hoistways.*

The running clearance between the cars and any equipment attached thereto, of elevators operating in a multiple hoistway, shall be not less than two (2) inches.

108.1d *Between Cars and Landing Sills.*

The clearance between the car-platform sill and the hoistway edge of any landing sill, or the hoistway side of any vertically sliding counter-weighted hoistway door or of any vertically sliding counter-balanced bi-parting hoistway door, shall be not less than one-half (½) inch where side guides are used, and not less than three-quarters (¾) inch where corner guides are used. The maximum clearance shall be not more than one and one-half (1½) inches.

108.1e *Clearance Between Loading Side of Car Platforms and Hoistway Enclosures.*

The clearance between the edge of the car-platform sill and the hoistway enclosure or fascia plate for the full width of the clear hoistway-door opening shall be not more than five (5) inches.

EXCEPTION: Where vertically sliding hoistway doors are installed, the clearance specified may be increased to seven and one-half (7½) inches. For heavy-duty elevators or extra-wide door openings, the clearance may be increased where necessary, subject to the approval of the enforcing authority.

108.1f *Measurement of Clearances.*

The clearances specified in this rule shall be measured with no load on the car platform.

SECTION 109 — PROTECTION OF SPACES BELOW HOISTWAYS

Rule 109.1. Hoistways Not Extending to the Lowest Floor of the Building

Where the space below the hoistway is used for a passageway or is occupied by persons, or if unoccupied is not secured against unauthorized access, the following requirements shall be conformed to:

- a Elevator counterweights shall be provided with safeties conforming to Rule 205.4
- b The cars and counterweights shall be provided with spring or oil buffers conforming to the following:
  - 1* Spring or oil buffers shall be provided for elevators and shall conform with Section 201.
  - 2 Spring buffers shall be so designed and installed that they will not be fully compressed when struck by the car with its rated load and by the counterweight at the following speeds:
    - a Governor tripping speed where the safety is governor operated.
    - b One hundred and twenty-five (125) percent of rated speed where the safety is not governor operated.
- c Car and counterweight-buffer supports shall be of sufficient strength to withstand without permanent deformation the impact resulting from buffer engagement at the following speeds:
  - 1 Governor tripping speed where the safety is governor operated.
  - 2 One hundred and twenty-five (125) percent of rated speed where the safety is not governor operated.

NOTE; For impact formula, see Section 1308.

SECTION 110 — PROTECTION OF HOISTWAY-LANDING OPENINGS

Rule 110.1* Entrances and Emergency Doors Required

All elevator hoistway-landing openings shall be provided with entrances which shall guard the full height and width of the openings.

Where an elevator is installed in a single blind hoistway, there shall be installed in the blind portion of the hoistway an emergency door at every third (3rd) floor, but not more than thirty-six (36) feet apart, conforming to the following:

- a* The clear opening shall be at least two (2) feet, four (4) inches wide and six (6) feet, six (6) inches high.
- b It shall be easily accessible and free from fixed obstructions.
- c It shall be either of the horizontally sliding or swinging single section type, irrespective of the type of door installed at other land-

ings.

d It shall be self-closing and self-locking and shall be marked in letters not less than two (2) inches high, "DANGER, ELEVATOR HOISTWAY."

e It shall be provided with a hoistway door interlock, conforming to Section 111, which can be unlocked from the landing side only through the use of a cylinder-type lock, having not less than a five (5) pin on five (5) disc combination. The cylinder lock shall:

1 Be located not less than five (5) feet above the floor.
2 Not be unlocked by any key which will open any other lock or device used for any purpose in the building.
3 Be so designed that the key shall be removable only in the locked position.

The key shall be kept where it is available only to authorized persons.

Rule 110.2* Types of Entrances

110.2a* *For Passenger Elevators and Freight Elevators Authorized to Carry Employees.*

Entrances shall be one of the following types:

1 Horizontal slide, single or multi-section.
2 Swing, single-section.
3 Combination horizontal slide and swing.
4 Power-operated, vertical slide bi-parting counterbalanced, or vertical slide counterweighted which slide down to open, where located at entrances used by passenger (See Rule 207.4).
5 Hand or power-operated vertical slide which slide up to open.

EXCEPTION: At landing openings used exclusively for freight, any type of entrance permitted by Rule 110.2b.

110.2b* *For Freight Elevators.*

Entrances shall be one of the following types:

1 Horizontal slide, single or multi-section.
2 Swing, single-section.
3 Combination horizontal slide and swing.
4 Center-opening, two-section horizontal swing (subject to restrictions of Rule 110.2c).
5 Vertical slide bi-parting counterbalanced (See Rule 207.4).
6 Vertical slide counterweighted, single or multi-section.

NOTE: See Rule 110.4 for location of horizontally sliding and swinging doors in relation to the edge of the landing sill.

110.2c* *Limitations of Use of Double Swing Entrances.*

Double swing entrances shall be permitted only:

1 For freight elevators which can be operated only from the car; or
2 For freight elevators not accessible to the general public which can be operated from outside the hoistway, and which are located in factories, warehouses, garages and similar industrial buildings.

Rule 110.3* Closing of Hoistway Doors

Horizontally sliding or swinging doors of automatic-operation elevators shall be provided with door-closers arranged to close an open door automatically if the car for any reason leaves the landing zone.

EXCEPTIONS:
(1) Center-opening horizontally swinging doors.
(2) The swinging portion of combination horizontally sliding and swinging type doors.

Horizontally sliding doors shall be closed when the car is at a landing except, when the elevator is operated by a designated operator in the car, when loading or unloading, and when the elevator is being actively dispatched by an automatic system which controls the doors.

Rule 110.4* Location of Horizontally Sliding or Swinging Hoistway Doors

Horizontally sliding or swinging doors shall be so located that the distance from the hoistway face of the doors to the edge of the hoistway landing sill, measured from the face of the door section nearest to the car, shall be not more than the following:

a For elevators which can be operated only from the car, four (4) inches.

EXCEPTION: Where new elevators are installed in existing multiple hoistways or where alterations involving replacement of the doors are made to existing elevators in multiple hoistways, and the location of the door openings is such that the four (4) inch dimension specified cannot be maintained, the distance specified may be increased to not more than five (5) inches where sliding-type doors are used.

b For elevators with automatic or continuous-pressure operation three-quarter (¾) inch for swinging doors and two and one-quarter (2¼) inches for sliding doors.

EXCEPTIONS:
(1) Freight elevators, not accessible to the general public, and which are located in factories, warehouses, garages, and similar type industrial buildings, may have single-section or center-opening two-section horizontally swinging doors located as permitted in Subdivision (a) of this rule.
(2) Three-quarter (¾) inch for swinging doors used with automatic and continuous-pressure operation may be increased to two and one-quarter (2¼) inches if such doors are emergency doors conforming to Rule 110.1.*

Rule 110.5* Projection of Entrances and Other Equipment Beyond the Landing Sills

Entrances and equipment, except that required for interlocking, indicator and signal devices and door operating devices, shall not project into an elevator hoistway beyond the line of the landing sill. *EXCEPTION: Vertical slide entrances.*

Rule 110.6 Opening of Hoistway Doors from Hoistway Side

Hoistway doors shall be so arranged that they may be opened by hand from the hoistway side when the car is within the interlock unlocking zone except when locked "out of service."

Means shall not be provided for locking "out of service" the doors either at the main-entrance landing or at the top or bottom terminal landing.

Automatic fire doors, the functioning of which is dependent on the action of heat, shall not lock any elevator hoistway door so that it cannot be opened manually from inside the hoistway nor shall such doors lock any exit leading from any elevator hoistway door to the outside of the building.

Handles or other means provided for operation of manually operated doors shall be so located that it is not necessary to reach back of any panel, jamb or sash to operate them.

NOTE:* This rule is not intended to prevent the manually opening of a hoistway door after manually manipulating the interlock so as to unlock the door.

Rule 110.7* Hoistway Door Vision Panels

Manually operated or self-closing hoistway doors of the vertically or horizontally sliding type, for elevators with automatic or continuous-pressure operation, shall be provided with a vision panel except at landings of automatic-operation elevators where a hall position indicator is provided. In multiple-section doors the vision panel is required in one section only, but may be placed in all sections. All horizontally swinging elevator doors shall be provided with vision panels. Vision panels may be provided for any type of hoistway door irrespective of the type of operation of the elevator.

Where required and used, vision panels shall conform to the following requirements.

a The area of any single vision panel shall be not less than twenty-five (25) square inches, and the total area of one (1) or more vision panels in any hoistway door shall be not more than eighty (80) square inches.

b Each clear panel opening shall reject a ball six (6) inches in diameter.

c Muntins used between panel sections shall be of noncombustible material and of substantial construction.

d Panel openings shall be glazed with clear wired glass not less than one-quarter (¼) inch thick.

e The center of the panel shall be located not less than fifty-four (54) inches nor more than sixty-six (66) inches above the landing; except that for vertically sliding bi-parting counterbalanced doors, it shall be located to conform with the dimensions specified insofar as the door design will permit.

f The vision panels in horizontally swinging doors shall be located for convenient vision when opening the door from the car side.

g Wired-glass panels in power-operated doors shall be substantially flush with the surface of the landing side of the door.

Rule 110.8 Hoistway-Door or Gate Counterweight Guides and Enclosures.

Hoistway-door or gate counterweights, where used, shall run in metal guides or shall be boxed in. The bottom of the guides or boxes shall be so constructed as to retain the counterweight if the counterweight suspension means breaks.

Rule 110.9 Hoistway-Door Locking Devices and Hoistway-Door Power Operators

110.9a *Locking Devices.*

Doors shall be provided with door-locking devices, hoistway access switches and parking devices conforming to the requirements of Section 111.

110.9b *Power-Operated, Power-Opened and Power-Closed Hoistway Doors.*

Where hoistway doors are power operated or are opened or closed by power, their operation shall conform to the requirements of Section 112.

Rule 110.10* Landing-Sill Guards, Landing-Sill Illumination, Hinged Landing-Sills and Tracks on Landings

110.10a* *Landing-Sill Guards.*

Landing sills, except those for elevators equipped with vertically sliding bi-parting counterbalanced doors or with vertically sliding counterweighted doors which slide down to open, shall be guarded on the underside with guard plates of smooth metal of not less than No. 16 U.S. gage extending not less than the full width of the car entrance and securely fastened in place as follows:

1* Where a car-leveling device is provided and the hoistway edge of

the sill is either flush with or projects into the hoistway, the guard shall have a straight vertical face extending below the sill not less than the depth of the leveling zone plus three (3) inches. Where the sill projects inward from the general line of the hoistway, the bottom of the guard shall also be beveled at an angle of not less than sixty (60) degrees nor more than seventy-five (75) degrees from the horizontal or the guard shall be extended from the hoistway edge of the landing sill to the soffit of the entrance next below.

EXCEPTION: Freight elevators with sills not projecting inward from the general line of the hoistway.

2* Where no car-leveling device is provided and the sill projects inward from the general line of the hoistway, the guard shall be either beveled at an angle of not less than sixty (60) degrees nor more than seventy-five (75) degrees from the horizontal or it may have a straight vertical face extending from the hoistway edge of the landing sill to the soffit of the entrance next below.

110.10b* *Illumination at Landing Sills.*

The building corridors shall be so lighted that the illumination at the landing sills, when an elevator is in service, shall be not less than five (5) foot candles.

110.10c* *Railroad Tracks on Elevator Landings.*

The tops of railroad tracks located on elevator landings shall be substantially flush with the floor surface for a distance of at least six (6) feet from the sill edge.

110.10d* *Hinged Hoistway Landing Sills.*

Hinged hoistway landing sills may be provided in connection with vertically sliding bi-parting, counterbalanced doors of freight elevators provided the sills are hinged on the landing side so that they can be lowered only when the landing doors are in the fully opened position.

Rule 110.11* Entrances, Horizontal Slide Type

110.11a* *Landing Sills.*

Landing sills shall:

1 Be of metal and of sufficient strength to support the load to be carried by the sills when loading and unloading the car, and be secured in place.

2 Be substantially flush with the floor surface of the elevator landings and so designed and maintained as to provide a secure foothold over the entire width of the door opening.

EXCEPTIONS:

(1) Where necessary, sills may be beveled or the landing floor may be ramped. The

angle with the horizontal shall be not greater than three (3) inches in twelve (12) inches for beveled sills nor greater than one (1) inch in twelve (12) inches for ramped landings.
(2) The top surface of beveled sills shall be not more than one and one-half (1½) inches above the adjacent floor surface.

110.11b* *Hanger Tracks and Track Supports.*

The tracks and their supports and fastenings for power operated doors shall be constructed to withstand without damage or appreciable deflection, an imposed static load equal to four (4) times the weight of each panel as applied successively downward and upward at the vertical centerline of the panel.

NOTE: See Rule 110.11e, 7 and 8.

110.11c* *Entrance Frames.*

Frames shall conform to the following:

1 If used, they shall overlap the wall surface on the hoistway side and provide a uniform surface on the hoistway side of the wall parallel to the plane of the panels.
2 They shall be securely anchored to the sills, and to the building structure or to the track supports. Anchors or fastenings to suit the wall construction are required and shall be not more than three (3) feet apart.
3 They shall be made of noncombustible material with a melting point not less than eighteen hundred (1800) degrees F. Combustible material not more than one-sixteenth (1/16) inch thick or low melting point noncombustible material may be applied for decorative purposes.

110.11d* *Hangers.*

Hangers shall conform to the following:

1 Means shall be provided to prevent the hangers from jumping the track.
2 Stops shall be provided in the entrance assembly to prevent hangers from over-running the end of the track.
3 For power-operated doors, they shall be constructed to withstand, without damage or appreciable deflection, an imposed static load equal to four (4) times the weight of each panel as applied successively downward and upward at the vertical centerline of the panel.

NOTE: See Rule 110.11e, 7 and 8.

110.11e* *Panels.*

Panels shall conform to the following:

1 The panels shall overlap the top and sides of the opening and each other, in the case of multi-speed entrances, by not less than one-half (½) inch.

2 The clearance between the panel and the frame and between related panels of multi-speed entrances shall not exceed three-eighths (3/8) inch.
3 The leading panel edge of side-opening entrances shall not close into pockets in the strike jamb and shall be smooth and free of sharp projections.
4 The meeting panel edges of center-opening entrances shall be smooth and free of sharp projections.

The meeting panel edges of center-opening entrances shall be protected with not less than one resilient male member extending the full height of the panel. The meeting edges may interlock by not more than three-eighths (3/8) inch.

When in the closed position, the distance between the metal parts of the meeting panels shall not exceed one-half (1/2) inch.
5 The panels shall have no area or molding depressed or raised more than one-quarter (1/4) inch from the exposed surface, unless they are parallel to the direction of panel motion. Areas depressed or raised more than one-eighth (1/8) inch from the adjacent area and not parallel to the direction of panel motion, shall be beveled at not more than thirty (30) degrees to the panel surface.
6 Combustible material not more than one-sixteenth (1/16) inch thick or low melting point noncombustible material may be applied to the panel surface for decorative purposes.
7 The entrance assembly shall be capable of withstanding a force of two hundred and fifty (250) pounds applied on the landing side at right angles to and approximately at the center of a panel. This force shall be distributed over an area of approximately four (4) inches by four (4) inches. There shall be no appreciable permanent displacement or deformation of any parts of the entrance assembly resulting from this test.
8 In case any combustible material or low melting point material, used in the entrance assembly, should be consumed or should melt, the allowable movement towards the hoistway of the panels from their normal operating position shall not at the top nor at the bottom exceed five-eighths (5/8) inch.

110.11f* *Bottom Guides.*

Bottom guides shall conform to the following:
1 The bottom of each panel shall be guided by one or more members.
2 Guide members shall be securely fastened.
3 The guide members and any reinforcements or guards shall engage the corresponding member by not less than one-quarter (1/4) inch.

NOTE: See Rule 110.11e, 7 and 8.

110.11g* *Interconnection of Panels.*

Panels of multi-panel entrances shall be interconnected directly or through their hangers so as to insure simultaneous movement of all panels.

The factor of safety of the interconnecting means shall be not less than:

1 Ten (10) for cast iron.
2 Five (5) for other materials.

Rule 110.12* Entrances, Vertical Slide Type

110.12a* *Landing Sills.*

Landing sills shall:

1 Be of metal and of sufficient strength to support the loads to be carried by the sills when loading and unloading car and be secured in place. See Rule 207.2b for classes of loading. The load on the sill during loading and unloading shall be considered to be the same as that on the platform members specified in Rule 1301.6.
2 Be firmly anchored to the building structure in substantially the same plane as the elevator landing floor.

110.12b* *Entrance Frames.*

The uprights and lintels used to frame the opening shall be securely fastened to the building structure at the top and bottom and to the wall.

110.12c* *Rails.*

The panel guide rails shall be securely fastened to the building structure and the entrance frame, at intervals, throughout their entire length.

Rails and their supports shall withstand the forces specified in Rule 110.12d-6. Where truckable sills are provided as specified in Rule 110.12d-2, the rails shall withstand any reactions resulting from the loading and unloading operation which may be transmitted to the rails.

110.12d* *Panels.*

Panels shall conform to the following:

1 The panels shall be constructed of noncombustible material.

EXCEPTION; A structural core made of combustible material may be used if covered with sheet metal of not less than No. 26 U.S. gage.

2 The lower panel of vertical bi-parting entrances and the top of the panel of vertical slide entrances which slide down to open, shall be provided with a truckable sill designed for the loads specified in Rule 110.12a-1. Provisions shall be made to transmit the panel sill load to the building structure.

3 Panels of bi-parting counterbalanced entrances shall conform to the following:
  a They shall be provided with means to stop the closing panels when the distance between the closing rigid members of the panel is not less than three-quarters (¾) inch.
  b A fire-resistive, non-shearing, non-crushing member of either the meeting or overlapping type shall be provided on the upper panel to close the distance between the rigid door sections when in contact with the stops.
  c Rigid members which overlap the meeting edge, and center latching devices are prohibited.
4 The panels with their attachments shall overlap the entrance frame and sill by not less than two (2) inches in the closed position.

EXCEPTION: Panels which close against the sill.

5 The clearance between a panel and the frame lintel, between a panel and the sill, and between related panels of multi-speed entrances, shall not exceed one (1) inch.
6 The entrance assembly shall be capable of withstanding a force of two hundred and fifty (250) pounds applied on the landing side at right angles, to, and approximately at the center of, a panel. This force shall be distributed over an area of approximately four (4) inches by four (4) inches. There shall be no appreciable permanent displacement or deformation of any parts of the entrance assembly resulting from this test.
7 Means shall be provided to close the opening between the upper panel of pass-type entrances and the entrance frame lintel. The sum of the clearance between the panel, the device used to close the opening, and the entrance lintel shall not exceed one (1) inch. The device used shall be made of a material having a melting point of not less than eighteen hundred (1800) degrees F.

110.12e* *Guides.*

Panel guides shall conform to the following:
1 Each panel shall be equipped with not less than four guide members or with continuous guides.
2 Guide members shall be securely fastened to the panels.
3 Guide members, if made of readily combustible material, or of material having a melting point of less than eighteen hundred (1800) degrees F, shall be reinforced with a material having a melting point of not less than eighteen hundred (1800) degrees F or be provided with other suitable guards, so as to prevent appreciable displacement if the other material burns or melts.

4 Guide members shall be designed to withstand the forces specified in Rule 110.12d-6.

110.12f* *Counterweighting or Counterbalancing.*

Single or multi-section vertically sliding panels shall be so counterweighted and vertically sliding bi-parting panels shall be so counterbalanced that they will not open or close by gravity.

Fastenings shall be provided to prevent the fall of a counterweight, detachment or dislodgment of counterweight parts or of balancing weights. Suspension means and their connections, for vertically sliding bi-parting counterbalanced doors and for the counterweights of vertically sliding counterweighted doors, shall have a factor of safety of not less than five (5).

110.12g* *Sill Guards.*

Where the panel sill or other structural member projects more than one-half (½) inch into the hoistway or beyond the panel surface below it, the projection shall be provided with a guard of not less than No. 16 U.S. gage metal beveled at an angle of not less than sixty (60) degrees nor more than seventy-five (75) degrees from the horizontal.

EXCEPTION: The sixty (60) degree limit may be reduced to fifty (50) degrees when practical difficulties are encountered on pass-type entrances.

110.12h* *Pull Straps.*

Manually operated bi-parting entrances of elevators which can be operated from the landings shall be provided with pull straps on the inside and outside of the upper panel where the lower edge of the upper panel is more than six (6) feet six (6) inches above the landing when the panel is in the fully opened position.

The length of the pull straps shall conform to the following:

1 The bottom of the strap shall be not more than six (6) feet six (6) inches above the landing when the panel is in the fully opened position.

2 The length of the strap shall not be extended by means of ropes or other materials.

Where pull straps are provided on doors of elevators which can be operated from the car only, the length of the pull straps shall conform to the requirements specified in 1 and 2 above.

Rule 110.13* Entrances, Swing Type

110.13a* *Landing Sills.*

Landing sills shall:

1 Be of metal and of sufficient strength to support the load to be carried by the sills when loading and unloading the car, and be

secured in place.

2 Be substantially flush with the floor surface of the elevator landings and so designed and maintained as to provide a secure foothold over the entire width of the door opening.

EXCEPTIONS:

(1) Where necessary, sills may be beveled or the landing floor may be ramped. The angle with the horizontal shall be not greater than three (3) inches in twelve (12) inches for beveled sills nor greater than one (1) inch in twelve (12) inches for ramped landings.

(2) The top surface of beveled sills shall be not more than one and one-half (1½) inches above the adjacent floor surface.

110.13b* *Entrance Frames.*

Frames shall conform to the following:

1 They shall be designed to support in place the panel(s) with its hinges or pivots, closer if attached to the frame and interlock. They shall withstand the forces referred to in Rule 110.13c-5, and the forces resulting from the normal opening of the door or normal attempts to open it when locked in the closed position.

2 Material used shall be noncombustible with a melting point not less than eighteen hundred (1800) degrees F.

3 Combustible materials not more than one-sixteenth (1/16) inch thick and low melting point noncombustible materials may be applied for decorative purposes.

110.13c* *Panels.*

Panels shall conform to the following:

1 The panel(s) shall overlap the part of the frame against which it closes by not less than one-half (½) inch.

2 The clearance between a panel and its sill shall not exceed three-eights (⅜) inch.

3 The panels of entrances used with automatic operation passenger elevators shall have no hand latches or other hand operated door fastening devices, nor shall such panels have any handles or knobs on the hoistway side.

4 Combustible material not more than one-sixteenth (1/16) inch thick and low melting point noncombustible material may be applied to the panel surface for decorative purposes.

5 The panel(s) and its assembled accessories shall be capable of withstanding normal attempts to open a closed and locked door by pulling the handle. The panel shall be so designed to withstand a force of two hundred and fifty (250) pounds applied on the landing side at right angles to and approximately at the center of the panel. This force shall be distributed over an area of approximately four (4) inches by four (4) inches. There shall be no appreciable permanent displacement or deformation of any parts of the entrance

assembly resulting from this force.

6 Panels of the tested types may be assembled to form combination slide and swing entrances. (See Rule 110.13e).

7 Panels of the tested types may be assembled to form double swing entrances provided the frames, sills, and hinges are similar to those of a tested assembly. A pair of swing panels shall also conform to the following:

a One panel shall be provided with an overlapping astragal on its vertical edge.

EXCEPTION: Where each panel is provided with an interlock or lock and contact. (See Rule 111.3b-4-c).

b Stops shall be provided at the top of both door sections which will stop the panels when closed. The stops shall withstand the forces referred to in Subdivision 5 of this rule.

110.13d* *Hinges.*

Hinges of the mortise and surface type shall conform to the requirements of the U.S. Department of Commerce CS9-65 or with NFPA No. 80-1970, Table #1.

Pivot hinges shall be identical with the hinges used in the test assembly.

110.13e* *Entrances with Combination Horizontally Sliding and Swinging Panels.*

The horizontally sliding and swinging panels forming a part of the entrance shall be so interconnected that:

1 The swinging panel can be opened only when the sliding panel is in the open position, and

2 Both panels swing as a unit.

EXCEPTION: Interconnection shall not be required where both the sliding and swinging panels are equipped with hoistway-door interlocks, or locks and electric contacts conforming to the requirements of Section 111.

Rule 110.14* Marking

110.14a* *Tested Assembly.*

One panel of each entrance assembly installed shall bear two labels conforming to the following:

1 One label shall carry the following information:

a The name of the panel manufacturer.

b A statement, by an agency acceptable to the authority having jurisdiction, certifying that the panel(s) are typical of the panel(s) tested in an assembly as specified in Section 1102.

2 One label shall carry the following information:

a The name of the contractor responsible for the entrance installation.
b A statement certifying that the entrance conforms to ANSI A17.1-1971.

EXCEPTION: A single label conforming to Subdivision 1 above is acceptable in cases where a complete assembly duplicates a tested assembly.

110.14b* *Other Assemblies.*

Other assemblies of the three basic types (see Rule 110.16) shall qualify for labels when composed of panels of the same type as tested panels and sizes not exceeding the largest panel tested, or of modifications of such panels when test data demonstrates that the modified panels will meet the performance requirements of the test procedure in Section 1102, provided all other elements of the assembly conform to all other applicable rules of this Code.

110.14c* *Entrances Larger than Tested Assemblies.*

When the entrance is too large for the regularly available test facilities, the labeling agency may issue oversize certificates or such entrances may be subject to approval by the authority having jurisdiction.

Rule 110.15* Factory Inspection

Factories manufacturing panels shall be inspected at random at least once each year by a laboratory or professional engineer acceptable to the authorities having jurisdiction, or to the certifying agency to insure that production methods are such that panels similar to those tested are being produced.

Rule 110.16* Fire Tests

Entrances shall be subjected to the tests specified in Section 1102.

Companies or groups of companies marketing any or all of the following basic types of entrances shall, for the basic types marketed, test the following complete assemblies:

a Entrances, Horizontal Slide Type: Test a single-slide and a center-opening assembly.
b Entrances, Swing Type: Test a single swing assembly.
c Entrances, Vertical Slide Type: Test a bi-parting assembly.

Rule 110.17** Transoms

Transoms may be used to close openings above the horizontal slide or horizontal swing type entrances provided:

a The opening closed by the transom does not exceed in width or

height the dimensions of the entrance above which it is installed.

b The transom panels are:

1 Constructed in a manner equivalent to the fire resistant construction of the entrance panels which have been successfully tested as a part of a one and one-half (1½) hour fire rated assembly and,

2 Securely anchored.

SECTION 111 — HOISTWAY-DOOR LOCKING DEVICES, CAR DOOR OR GATE ELECTRIC CONTACTS, HOISTWAY ACCESS SWITCHES, AND ELEVATOR PARKING DEVICES

Rule 111.1 Locking Devices Required

111.1a *For Passenger Elevators.*

Hoistway doors shall be equipped with hoistway-unit system hoistway-door interlocks.

111.1b *For Freight Elevators.*

Hoistway doors shall be equipped with hoistway-unit system hoistway-door interlocks.

EXCEPTION: Hoistway-unit system combination mechanical locks and electric contacts may be used for manually opened vertically sliding counterweighted or vertically sliding bi-parting counterbalanced doors under the following conditions:

(1) Elevators with a Travel of Fifteen (15) Feet or Less. For the top landing door and for any door whose sill is located not more than four (4) feet below the sill of the top landing door.

(2) Elevators with Any Travel. For any door whose sill is within five (5) feet of the bottom of the pit.

Rule 111.2 Car Door or Gate Electric Contacts

Car doors or gates, including side emergency-exit doors of passenger elevators, shall be provided with car door or gate electric contacts.

Rule 111.3 Hoistway-Door Interlocks and Operating Cams

111.3a *Operation of the Driving Machine with a Hoistway Door Unlocked or Not in the Closed Position.*

Operation of the driving machine when a hoistway door is unlocked or not in the closed position (See Rule 111.7) is permissible under the following conditions:

1 By a car-leveling or truck-zoning device (See Rule 210.1e).

2 By a combination hoistway access switch and operating device (See Rule 111.9).

3 When a hoistway access switch is operated (See Rule 111.9).

111.3b *General Design Requirements.*

Interlocks shall conform to the following requirements:

1 Interlock contacts shall be positively opened by the locking member or by a member connected to and mechanically operated by the locking member, and the contacts shall be maintained in the open position by the action of gravity or by a restrained compression spring, or by both, or by means of the opening member.

2 The interlock shall hold the door in the locked position by means of gravity or by a restrained compression spring, or by both, or by means of a positive linkage.

3 The interlock shall lock the door in the closed position before the driving machine can be operated by the normal operating device.

EXCEPTION: As provided in Rule 111.3a.

Devices which permit operation of the driving machine by the normal operating device when the door is closed but before it is locked, are not interlocks and are not permitted where interlocks are required by this code.

4 Interlocks, used with multi-section doors, shall conform to the following requirements:

a They shall lock all sections of the door, but may be applied to only one section of the door provided the device used to interconnect the door sections is so arranged that locking one section will prevent the opening of all sections (See Rule 110.11g).

b Where used with vertically sliding bi-parting counterbalanced doors, they shall be so arranged that the interlock contacts are mechanically held in the open position by the door or devices attached thereto unless the door is in the closed position.

c Where used with center-opening horizontally swinging doors, both door sections shall be equipped with interlocks.

EXCEPTION: Where the door sections are so arranged that one section can be opened only after the other section has been opened, the interlock may be omitted on the section which opens last and a hoistway-unit system hoistway-door electric contact provided on this door section in its place. (See Rule 110.13e)

d Where used with combination horizontally sliding and swinging doors, the sliding and swinging panels shall be equipped with interlocks.

EXCEPTION: Where the sliding and swinging panels are interconnected in conformity with the requirements of Rule 110.13e, the interlock may be omitted on the swinging panel provided that the interlock on the sliding panel is so designed and installed that the car cannot be operated unless the sliding and swinging panels are both locked in the closed position as defined in Rule 111.7a.

e Where a door-closer, used with a combination sliding and swing-

ing door, is arranged to be disconnected to allow the sliding panel to swing, it shall be so designed and installed that it shall not make the interlock contact when disconnected and released.

5 Interlock systems employing a single master switch for more than one door are prohibited.

111.3c *Interlock Retiring Cam Device.*

Retiring cams used to actuate an interlock shall exert a force at least double the average force required to operate the interlock and shall have a movement at least one-half (½) inch more than the average movement required to operate the interlock.

An interlock retiring cam device shall be permanently marked by the manufacturer with:

a Its rated horizontal force.

b Its rated horizontal movement.

111.3d *Location.*

Interlocks shall be so located that they are not accessible from the landing side when the hoistway doors are closed.

Rule 111.4 Hoistway-Door Combination Mechanical Locks and Electric Contacts

111.4a *Where Permitted.*

Hoistway-door combination mechanical locks and electric contacts are permitted only for freight elevators as specified in Rule 111.1b.

111.4b *Operation of the Driving Machine with a Hoistway Door Not in the Closed Position.*

Operation of the driving machine when a hoistway door is not in the closed position is permissible under the following conditions:

1 By a car-leveling or truck-zoning device (See Rule 210.1e).

2 By a combination hoistway access switch and operating device (See Rule 111.9).

3 When a hoistway access switch is operated (See Rule 111.9).

111.4c *General Design Requirements.*

Combination mechanical locks and electric contacts shall conform to the following requirements:

1 They shall be so designed that the locking member and the electric contact are mounted on and attached to a common base in such a manner that there is a fixed relation between the location of the contact and the location of the locking member. They shall be so installed and adjusted that the electric contact cannot close until

the door is in the closed position as specified in Rule 111.7b, and so that the locking member is in a position to lock the door when or before the contact closes. In order to prevent motion of the door from opening the electric contact while the door is locked in the closed position, multiple-locking points shall, where necessary, be provided on the locking mechanism.

2 The electric contact shall be positively opened by the locking bar of the mechanical lock or by a lever or other device attached to and operated by the door; and the contact shall be maintained in the open position by the action of gravity or by a restrained compression spring, or by both, or by positive mechanical means.

3 The mechanical lock shall hold the door in the locked position by means of gravity or by a restrained compression spring, or by both.

4 Combination mechanical locks and electric contacts used with multi-section doors shall conform to the following requirements:
 a They shall lock all sections of the door, but may be applied to only one section of the door provided the device used to interconnect the door sections is so arranged that locking one section will prevent the opening of all sections (See Rule 110.11g).
 b Where used with vertically sliding bi-parting counterbalanced doors, the electric contact shall be so arranged that it is mechanically held in the open position by the door or a device attached thereto unless the door is in the closed position.

111.4d *Location.*

Combination mechanical locks and electric contacts shall be so located that they are not accessible from the landing side when the hoistway doors are closed.

Rule 111.5 Hoistway-Door and Car Door or Gate Electric Contacts

111.5a *Operation of the Driving Machine with a Hoistway Door or Car Door or Gate Not in the Closed Position.*

Operation of the driving machine when a hoistway or car door or gate is not in the closed position is permissible under the following conditions:
1 By a car-leveling or truck-zoning device (See Rule 210.1e).
2 By a combination hoistway access switch and operating device (See Rule 111.9).
3 When a hoistway access switch is operated (See Rule 111.9).

111.5b *Location of Car-Door or Gate Electric Contacts.*

Car door or gate electric contacts shall be so located that they are not readily accessible from the inside of the car.

111.5c *General Design Requirements.*

Hoistway-door and car door or gate electric contacts shall conform to the following:

1 They shall be positively opened by a lever or other device attached to and operated by the door or gate.
2 They shall be maintained in the open position by the action of gravity or by a restrained compression spring, or by both, or by positive mechanical means.
3 Hoistway-door electric-contact systems employing a single master switch for more than one door are prohibited (See also Rules 111.3b-4c and 111.4c-4c).

Rule 111.6 Test, Approval, and Identification of Hoistway-Door Locking Devices and Hoistway-Door and Car Door or Gate Electric Contacts

111.6a *Engineering Tests.*

Each type and make of hoistway-door interlock, hoistway-door combination mechanical lock and electric contact, and hoistway-door and car door or gate electric contact, shall be subjected to the engineering tests specified in Section 1101, by or under the supervision of a qualified laboratory (See also Rule 1101.2).

111.6b *Approval, Inspection, and Tests.*

Each type and make of hoistway-door interlock, hoistway-door combination mechanical lock and electric contact, and hoistway-door and car door or gate electric contact which has successfully passed the tests specified in Section 1101, and which conforms to the applicable provisions of this code, shall be approved for use by the enforcing authority.

Interlock switches which have met the engineering test requirements of Section 1101, and which have been approved by the enforcing authority, may be installed in connection with existing approved door-closers and the combination door-closer and interlock switch approved as an interlock by the enforcing authority without additional tests, provided the combination door-closer and interlock switch are installed and adjusted to conform to all the requirements of Rule 111.3.

Minor changes in design may be made without retesting, subject to the approval of the enforcing authority.

111.6c *Field Inspection and Tests.*

Approved devices shall be inspected and tested in the field for conformity with the requirements of Section 111.

111.6d *Identification.*

Approved devices shall be marked for identification. The marking shall be permanent and so located as to be readily visible when the device is mounted in position.

Only one identification marking is required and shall include the following:

1 Manufacturer's name or trademark.
2 Type or style letter or number.
3 Rated voltage.
4 Rated test force (See Rule 1101.4-g).
5 Rated test movement (See Rule 1101.4-g).

EXCEPTION: Items 4 and 5 are applicable only when an interlock retiring cam device is required. (See Rule 111.3c and definition).

Rule 111.7 Closed Position of Hoistway Doors and Car Doors or Gates

111.7a *Hoistway Doors Provided with Hoistway-Door Interlocks.*

Hoistway doors shall be considered to be in the closed position under the following conditions:

1 For horizontal sliding or swinging doors, or vertically sliding counterweighted doors:
  a Only when the leading edge of the door is within four (4) inches of the nearest face of the jamb or when the door panels of bi-parting type doors are within four (4) inches of contact with each other, provided that:
    1 The car is being operated from within the car only.
    2 The doors are of the horizontally sliding type.
    3 The doors are power closed or equipped with door-closers.
    4 The hoistway-door interlock is provided with means to lock the door on closing when or before the interlock contact closes, so that the door cannot be opened from the landing side more than four (4) inches from any position between this position and the closed position, as defined in Subdivision 1b of this rule.
    5 The door-closing device is of a type which will normally

close the door to the closed position as defined in Subdivision 1b of this rule, and lock it in this position.

b For conditions which do not conform to Subdivision 1a of this rule, only when the leading edge of the door is within three-eighths (3/8) inch of the nearest face of the jamb or sill or when the panels of horizontally sliding bi-parting doors are within three-eighths (3/8) inch of contact with each other.

2 For vertically-sliding bi-parting counterbalanced doors when the closing doors are not more than three-quarters (3/4) inch from their stopped position (See Rule 110.12d-3a).

111.7b *Hoistway Doors Provided with Hoistway-Door Combination Mechanical Locks and Electric Contacts, or with Hoistway-Door Electric Contacts.*

Hoistway doors provided with hoistway-door combination mechanical locks and electric contacts, and hoistway doors provided with hoistway-door electric contacts, shall be considered to be in the closed position under the following conditions:

1 For horizontally sliding or swinging doors, when the clear open space between the leading edge of the door and the nearest face of the door jamb does not exceed two (2) inches.

2 For vertically sliding counterweighted doors, when the clear open space between the leading edge of the door and the landing sill does not exceed two (2) inches.

3 For center-opening bi-parting horizontally sliding doors or bi-parting vertically sliding counterbalanced doors, when the door panels are within two (2) inches of contact with each other.

4 For center-opening horizontally swinging doors, when the clear open space between each door panel and its jamb does not exceed two (2) inches; provided that if a hoistway-door electric contact is used on the door panel which opens last (see Rule 111.4c-4c), the door contact shall not make contact unless this door panel is in a position to be engaged by the overlapping astragal on the other door panel.

111.7c *Car Doors or Gates Provided with Car Door or Gate Electric Contacts.*

Car doors or gates shall be considered to be in the closed position under the following conditions:

1 For horizontally sliding doors or gates, when the clear open space between the leading edge of the door or gate and the nearest face of the jamb does not exceed two (2) inches.

2 For vertically sliding counterweighted doors or gates, when the clear open space between the leading edge of the door or gate and

the car platform sill does not exceed two (2) inches.

3 For horizontally sliding bi-parting doors, or vertically sliding bi-parting counterbalanced doors, when the door panels are within two (2) inches of contact with each other.

EXCEPTION: When elevators are being operated from the car only, the clear open space specified for a horizontally sliding door or gate may be increased to four (4) inches; provided that the door or gate is equipped with a door-closer or is power closed or power operated, and the hoistway doors are equipped with hoistway-door interlocks and are power closed or power operated or equipped with door-closers conforming to Rule 111.7a-1a.

Rule 111.8 Elevator Parking Device

111.8a *Where Required.*

An elevator parking device shall be provided at one landing, and may be provided at other landings.

EXCEPTION; Elevators having hoistway doors which are automatically unlocked when the car is within the landing zone.

111.8b *General Design Requirements.*

Parking devices shall conform to the following requirements.

1 They shall be mechanically or electrically operated.

2 They shall be designed and installed so that friction or sticking or the breaking of any spring used in the device will not permit opening or unlocking a door when the car is outside the landing zone of that floor.

3 Springs, where used, shall be of the restrained compression type which will prevent separation of the parts in case the spring breaks.

Rule 111.9 Access to Hoistway for Inspection, Maintenance or Repairs

Access means conforming to either Rule 111.9a or Rule 111.9d shall be provided at one upper landing to permit access to top of car, and at the lowest landing if this landing is the normal point of access to the pit.

119.a *Hoistway Access Switch.*

Elevators having hoistway doors which are locked when closed with car at landing shall be provided with hoistway access switch or switches conforming to Rule 111.9b and Rule 111.9c.

EXCEPTIONS:

(1) Elevators having hoistway doors which are openable from landing by means effective only when car is in landing zone. It is only necessary that this means open the door of any one of several cars at a landing.

(2) Access to top of elevators with a travel of fifteen (15) feet or less provided upper access landing is no more than four (4) feet below the top landing.

(3) Access to pit of elevators provided lowest landing is not more than five (5) feet above the pit floor.

111.9b *Location and Design of Hoistway Access Switches.*

Hoistway access switches shall conform to the following:

1 The switch shall be installed only at the access landings.

2 The switch shall be installed adjacent to hoistway entrance at the access landing with which it is identified.

3 The switch shall be of the continuous-pressure spring-return type, and shall be operated by a cylinder-type lock having not less than a five (5) pin or five (5) disc combination with the key removable only when the switch is in the "OFF" position. The lock shall not be operable by any key which will operate locks or devices used for other purposes in the building. The key shall be available to and used only by inspectors, maintenance men, and repairmen.

111.9c *Operating Requirements of Hoistway Access Switches.*

The operation of the switch at either access landing shall permit, and may initiate and maintain, movement of the car with the hoistway door at this landing unlocked or not in the closed position, and with the car door or gate not in the closed position, subject to the following:

1 The operation of the switch shall not render ineffective the hoistway door interlock or electric contact at any other landing.

2 The car cannot be operated at a speed greater than one hundred and fifty (150) feet per minute.

3 For automatic and continuous-pressure operation elevators, provided:

a Landing operating devices of continuous-pressure operation elevators, and car and landing operating devices of automatic-operation elevators shall first be made inoperative by means other than the access switch.

b Power operation of the hoistway door and/or car door or gate is inoperative.

4 Automatic operation by a car-leveling device is inoperative.

5 The top-of-car operating device (See Rule 210.1d) is inoperative.

Where electrically operated switches, relays or contactors are used to render inoperative the hoistway-door interlock or electric contact or the car door or gate contact, the control circuits shall be arranged to conform to the requirements of Rule 210.9c, and in addition to render the normal car and hall operation ineffective if any such switch, relay or contactor fails to function in the intended manner.

111.9d *Hoistway Door Unlocking Device.*

Elevators described under exceptions to Rule 111.9a and elevators having hoistway doors which are unlocked when closed with car at landing, shall be provided with hoistway door unlocking devices or devices conforming to Rule 111.9e.

EXCEPTION: Hoistway access switches conforming to Rule 111.9b and Rule 111.9c may be used in lieu of hoistway door unlocking devices if desired.

111.9e *Design Requirements of Hoistway Door Unlocking Devices.*

Hoistway door unlocking devices shall conform to the following:

1 The device shall unlock and permit the opening of the hoistway door from the access landing irrespective of the position of the car.

2 The device shall be installed only at the access landings.

EXCEPTION: Emergency use per Rule 111.10.

3 The device shall be designed to prevent unlocking the door with common tools.

4 The operating means for unlocking the door shall be available to and used only by inspectors, maintenance men, and repairmen.

NOTE: For diagrammatic representation see Appendix C.

Rule 111.10* Access to Hoistways for Emergency Purposes

Hoistway door unlocking devices conforming to Rules 111.9e-1 and 111.9e-3 may be provided for all hoistway doors subject to the following:

1 The elevator shall have hoistway doors which are unlocked when closed with the car at floor, or locked but openable from landing by means effective only when car is in landing zone.

2 The operating means for unlocking the doors shall be kept on the premises by the person responsible for the maintenance and operation of the elevators in a location readily accessible to qualified persons in case of an emergency but where they are not accessible to the general public.

EXCEPTION: Emergency hoistway doors which shall be provided with unlocking devices conforming to Rule 110.1.

NOTE: For diagrammatic representation see Appendix C.

Rule 111.11 Devices for Making Inoperative Hoistway-Door Interlocks or Contacts, or Car-Door or Gate Contacts

Devices other than those specified in Rule 111.9 and in Rule 210.1e, shall not be installed to render inoperative hoistway-door interlocks, the contacts of combination mechanical locks and electric contacts, or car-door or gate electric contacts (See also Rule 1002.4).

SECTION 112 — POWER-OPERATION, POWER-OPENING, AND POWER-CLOSING OF HOISTWAY DOORS AND CAR DOORS OR GATES

Rule 112.1 Types of Doors and Gates Permitted

Where both a hoistway door and a car door or gate are opened and/or

closed by power, the hoistway door and the car door or gate shall:
a Both be of the horizontally sliding type or
b Both be of the vertically sliding type.

Rule 112.2 Power-Opening

112.2a *Power-Opening of Car Doors or Gates.*

Power-opening of a car door or gate shall be subject to the following:
1 Power-opening shall occur only when the car is stopping, or is leveling, or is at rest, and may take place at any position in the hoistway.
2 Collapsible-type car gates shall not be power opened to a distance exceeding one-third (1/3) the clear gate opening, and in no case more than ten (10) inches.

112.2b *Power-Opening of Hoistway Doors.*

Power-opening of a hoistway door shall conform to the following:
1 Power-opening shall occur only at that landing where the car is stopping, or is leveling, or is at rest, and shall start only when the car is within the landing zone or is within the leveling zone where an automatic car-leveling device is provided.
2 Power-opening may be initiated automatically through control circuits provided that the car is being automatically stopped or leveled and provided that, when stopping under normal operating conditions, the car shall be at rest or substantially level with the landings before the hoistway door is in the fully open position.
3 Sequence opening of a vertically sliding hoistway door and adjacent car door or gate shall be provided where required by Rule 112.6.

Rule 112.3 Power-Closing

112.3a *Power-Closing or Automatic Self-Closing of Car Doors or Gates where used with Manually Operated or Self-Closing Hoistway Doors.*

Where a car door or gate of an automatic or continuous-pressure operation passenger elevator is closed by power, or is of the automatically released self-closing type, and faces a manually operated or self-closing hoistway door, the closing of the car door or gate shall not be initiated unless the hoistway door is in the closed position; and the closing mechanism shall be so designed that the force necessary to prevent closing of a horizontally sliding car door or gate from rest shall be not more than thirty (30) pounds.

EXCEPTION: Where a car door or gate is closed by power through continuous-pressure of a door-closing switch, or of the car operating device, and where the release of the closing switch or operating device will cause the car door or gate to stop or to stop and reopen.

112.3b *Power-Closing of Hoistway Doors and Car Doors or Gates by Continuous-Pressure Means.*

Horizontally or vertically sliding hoistway doors with manually-closed, or power-operated, or power-closed car doors or gates may be closed by continuous-pressure means subject to the following:

1 The release of the closing means shall cause the hoistway door, and a power-operated or power-closed car door or gate, to stop or to stop and reopen.

2 The operation of the closing means at any landing shall not close the hoistway door at any other landing nor the car door or gate when the elevator car is at any other landing.

3 For elevators having more than one hoistway opening at any landing level, a separate closing means shall be provided in the car for each car door or gate and its adjacent hoistway door. Any closing means at a landing shall close only that hoistway door and the car door or gate at the side where such means is located.

EXCEPTION: A separate closing means need not be furnished for a horizontally sliding hoistway door and adjacent car door or gate which conform to the requirements of Rule 112.4.

4 Sequence closing of a vertically sliding hoistway door and adjacent car door or gate shall be provided where required by Rule 112.6.

112.3c *Power-Closing of Horizontally Sliding Hoistway Doors and Horizontally Sliding Car Doors or Gates by Momentary Pressure or by Automatic Means.*

Power-closing by momentary pressure or by automatic means shall be permitted only for automatic or continuous-pressure operation elevators. The closing of the doors shall be subject to the following:

1 It shall conform to the requirements of Rule 112.4.

2 A momentary-pressure switch shall be provided in the car, the operation of which shall cause the doors to stop or to stop and reopen.

112.3d *Power-Closing of Vertically Sliding Hoistway Doors and Vertically Sliding Car Doors or Gates by Momentary Pressure or by Automatic Means.*

Power-closing by momentary pressure or by automatic means shall be permitted only for automatic or continuous-pressure operation elevators.

Vertically sliding hoistway doors used with vertically sliding power-operated car doors or gates may be closed by momentary pressure or

automatic means subject to the following:

1 A warning bell or other audible signal shall be provided on the car which shall start to sound at least five (5) seconds prior to the time the car door or gate starts to close and shall continue to sound until the hoistway door is substantially closed.

EXCEPTION: The five-second time interval may be omitted when the doors are closed by a closing switch in the car.

2 Sequence closing of the hoistway door and adjacent car door or gate shall be provided and shall conform to the requirements of Rule 112.6.

3 The car door or gate shall be equipped with a reopening device conforming with the requirements of Rule 112.5.

4 A momentary-pressure type switch shall be provided in the car and at each landing, which, when operated, shall cause the car door or gate and the hoistway door at the landing to stop or to stop and reopen.

5 The average closing speed shall not exceed one (1) foot per second for a vertically sliding counterweighted hoistway door or for each panel of a bi-parting counterbalanced hoistway door or car gate, and shall not exceed two (2) feet per second for a vertically sliding counterweighted car door or gate.

Rule 112.4 Kinetic Energy and Force Limitations for Power Door Operators Used with Horizontally Sliding Hoistway Doors and Horizontally Sliding Car Doors or Gates

Where a power-operated horizontally sliding hoistway door is closed by momentary-pressure or by automatic means (See Rule 112.3c), or is closed simultaneously with another door from one continuous-pressure means (See Rule 112.3b-3), the closing mechanism shall be designed and installed to conform to the following requirements:

a The kinetic energy of the hoistway door and all parts rigidly connected thereto, computed for the average closing speed, shall not exceed seven (7) foot pounds where a reopening device for the power-operated car door or gate conforming to the requirements of Rule 112.5 is used and shall not exceed two and one-half (2½) foot pounds where such door reopening device is not used. Where the hoistway door and the car door or gate are closed in such a manner that stopping either one manually will stop both, the sum of the hoistway and the car door weights as well as all parts connected rigidly thereto shall be used to compute the kinetic energy.

The average closing speed shall be determined by timing the closing door as follows:

1 With single-slide and two-speed doors, determine the time re-

quired for the leading edge of the door to travel from a point two (2) inches away from the open jamb to a point two (2) inches away from the opposite jamb.

2 With center-opening or two-speed center-opening doors, determine the time required for the leading edge of the door to travel from a point one (1) inch away from the open jamb to a point one (1) inch from the center meeting point of the doors.

b The force necessary to prevent closing of the hoistway door (or the car door or gate if power operated) from rest shall be not more than thirty (30) pounds.

Rule 112.5 Reopening Device for Power-Operated Car Doors or Gates

Where required by Rule 112.3d or Rule 112.4, a power-operated car door or gate shall be provided with a reopening device which will function to stop and reopen a car door or gate and the adjacent hoistway door in the event that the car door or gate is obstructed while closing.

For center opening doors the reopening device shall be so designed and installed that the obstruction of either door panel when closing will cause the reopening device to function.

Rule 112.6 Sequence Operation for Power-Operated Hoistway Doors with Car Doors or Gates

112.6a *Where Required.*

Sequence operation shall be provided under the following conditions:

1 Sequence opening and closing shall be provided for power-operated vertically sliding bi-parting counterbalanced or power-operated vertically sliding hoistway doors which slide down to open, where used on passenger elevators or on freight elevators permitted to carry employees (See Rule 207.4) in conjunction with a power-operated vertically sliding car door or gate.

EXCEPTION: Doors at openings used exclusively for freight.

2 Sequence closing shall be provided for power-operated vertically sliding hoistway doors and vertically sliding car doors or gates which are closed by momentary pressure or by a timing device.

112.6b *Operating Requirements.*

The sequence operation of a hoistway door and adjacent power-operated vertically sliding car door or gate shall conform to the following:

1 In opening, the hoistway door shall be opened at least two-thirds (2/3) of its travel before the car door or gate can start to open.

2 In closing, the car door or gate shall be closed at least two-thirds (2/3) of its travel before the hoistway door can start to close.

PART II

**MACHINERY AND EQUIPMENT FOR ELECTRIC ELEVATORS

SCOPE

**This part applies to electric elevators.

Many of the rules also apply to hydraulic elevators, power sidewalk elevators and to power dumbwaiters and a few of the rules relate to hand elevators and dumbwaiters, all as referenced in their respective Parts of this Code.

SECTION 200 — CAR AND COUNTERWEIGHT GUIDE RAILS, GUIDE-RAIL SUPPORTS AND FASTENINGS

Rule 200.1 Guide Rails Required

Passenger and freight elevators shall be provided with car and counterweight guide rails.

Rule 200.2 Material

Guide rails, guide-rail brackets, rail clips, fishplates and their fastenings shall be of steel or other metals conforming to the requirements of this section.

EXCEPTION: Where steel may present an accident hazard, as in chemical or explosive plants, guide rails may be of selected wood or other suitable non-metallic materials provided the rated speed of the car does not exceed one hundred fifty (150) feet per minute.

200.2a *Requirements for Steel*

Steel where used, shall conform to the following:

1 Rails, Brackets, Fishplates, and Rail Clips. Rails, brackets, fishplates, and rail clips shall be made of open-hearth steel or its equivalent having a tensile strength of not less than fifty-five thousand (55,000) pounds per square inch and having an elongation of not less than twenty-two (22) percent in a length of two (2) inches.

2 Bolts. Bolts shall conform to ASTM Specification A307-67.

3 Rivets. Rivets shall conform to ASTM Specification A502-65.

See Rule 200.5 for maximum permissible stresses and deflections.

200.2b *Requirements for Metals other than Steel.*

Metals other than steel may be used provided the factor of safety is not less than, and the deflections not more than, the values specified in this section, and provided that cast iron is not used.

Rule 200.3 Rail Section

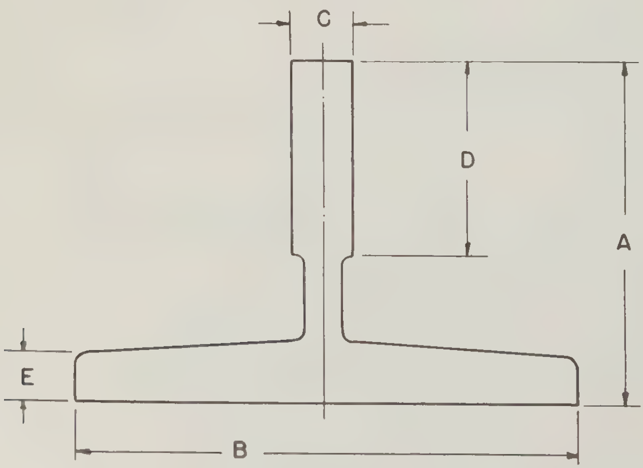
Guide rails shall be T-section, conforming to the nominal weights and dimensions shown in Figure No. 200.3 and Table No. 200.3.

EXCEPTIONS: Other approved shapes may be used subject to the following requirements:

(1) They shall have a section modulus and moment of inertia equal to or greater than that of the section shown in Figure No. 200.3 for a given loading condition.

(2) They shall have a sectional area sufficient to withstand the compressive forces resulting from the application of the car or counterweight safety device.

ELEVATOR GUIDE RAILS



T SECTION RAIL
FIG. 200.3

Table 200.3

GUIDE RAIL DIMENSIONS

Nominal Weight Per Foot in lb	Nominal Dimensions in Inches				
	A	B	C	D	E
8	2-7/16	3-1/2	5/8	1-1/4	5/16
11	3-1/2	4-1/2	5/8	1-1/2	5/16
12	3-1/2	5	5/8	1-3/4	5/16
15	3-1/2	5	5/8	1-31/32	1/2
18-1/2	4-1/4	5-1/2	3/4	1-31/32	1/2
22-1/2	4	5-1/2	1-1/8	2	9/16
30	5	5-1/2	1-1/4	2-1/4	11/16

Rule 200.4 Maximum Load on Rails in Relation to the Bracket Spacing

200.4a *With Single Car or Counterweight Safety.*

Where a single car or counterweight safety is used the maximum suspended weight of the car and its rated load, or the maximum suspended weight of the counterweight, including the weight of any compensating ropes or chains and of any traveling cables suspended therefrom, per pair of guide rails, shall not exceed the maximum specified in Figure No. 200.4a(1) for the size of the rail and the bracket spacing used.

EXCEPTIONS: The bracket spacing may exceed the values specified in Figure No. 200.4a(1) for a given weight of car plus its rated load or for a counterweight with a safety, per pair of guide rails, provided:

(1) The guide rail is reinforced; or

(2) A rail of larger size is provided; and

(3) In cases (1) and (2) the moment of inertia of a single reinforced rail or of a single larger size T-section about the axis (I-I) parallel to the base of the rail shall be not less than that required by Figure 200.4a(2) for the given weight of car plus load, or the counterweight with safety device, at the bracket spacing used.*

EXAMPLE: For 12,000 lb total weight of car plus load and a bracket spacing of 16′-0″, there is required:

a An 18½ lb rail without reinforcement, or

b A 15 lb rail with reinforcement having a combined $I = 8$ inches^4.

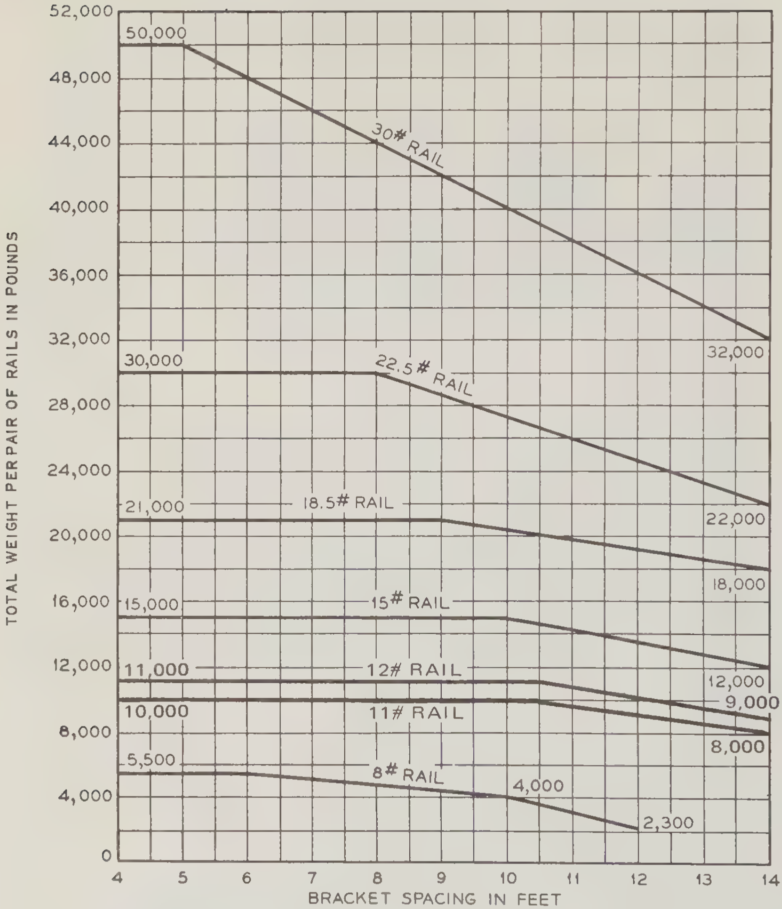


Fig. 200.4a(1)* Maximum Weight of Car with Rated Load or of Counterweight with Safety Device for a Pair of Guide Rails as specified in Rule 200.4a.

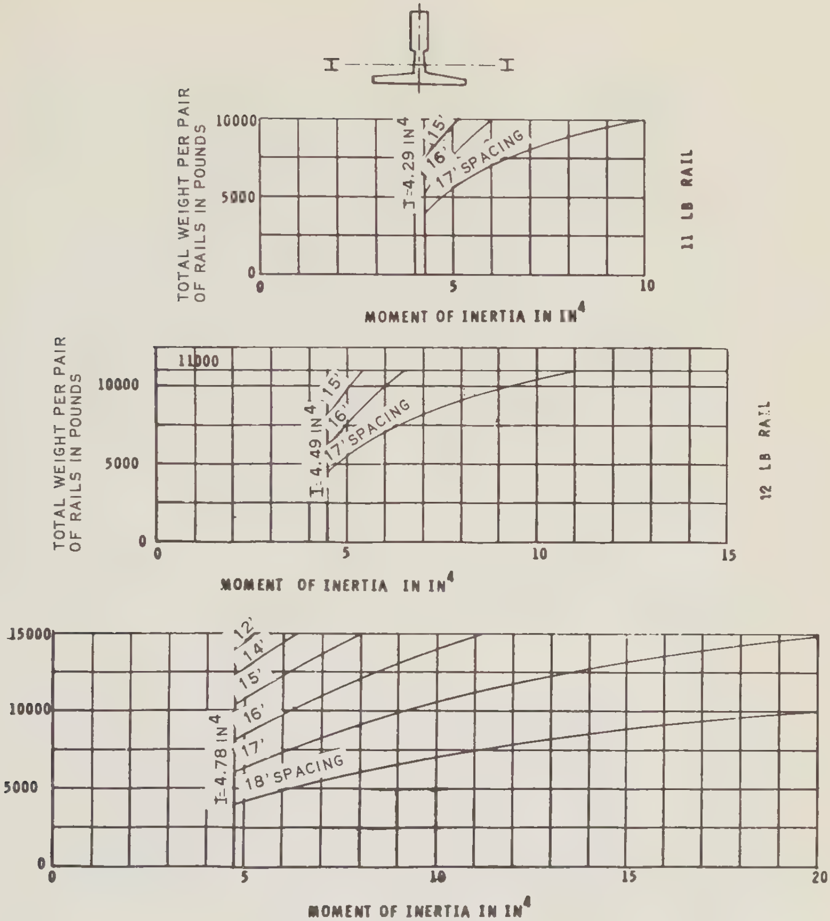
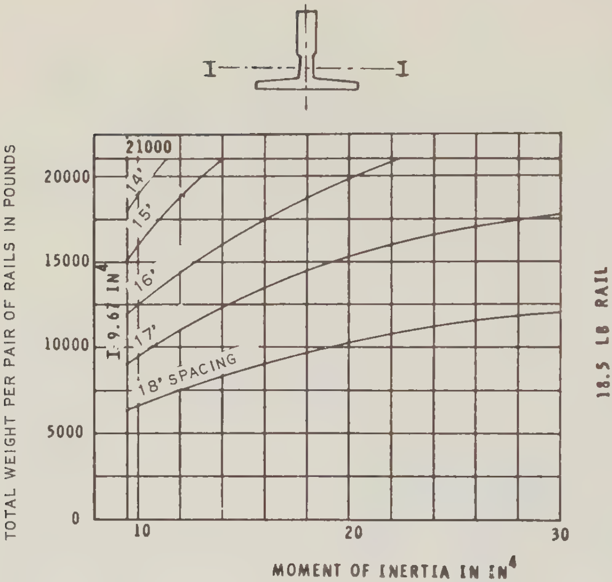


Fig. 200.4a(2)* Minimum Moment of Inertia about I-I Axis for a Single Guide Rail with its Reinforcement.



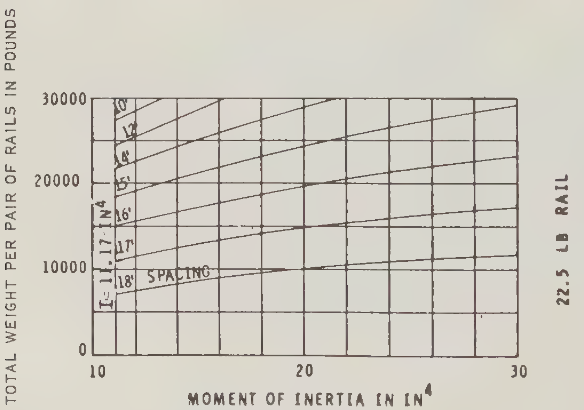


Fig. 200.4a(2)* cont'd Minimum Moment of Inertia about I-I Axis for a Single Guide Rail with its Reinforcement

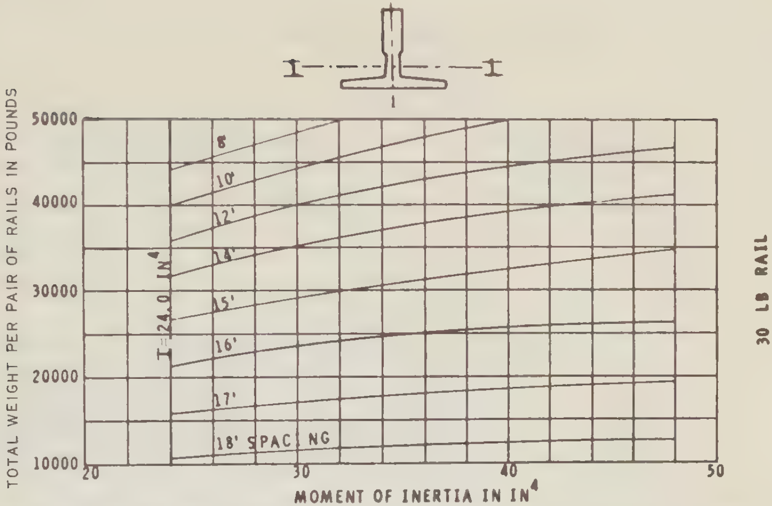


Fig. 200.4a(2)* cont'd Minimum Moment of Inertia about I-I Axis for a Single Guide Rail with its Reinforcement

200.4b *With Two (Duplex) Car or Counterweight Safeties.*

Where the car or counterweight is provided with two safety devices, the loads specified in Figure No. 200.4a(1) may be increased by the factors specified in Table No. 200.4b.

200.4c *Counterweight with No Safety.*

Guide rails for counterweights not provided with a safety device shall be fastened to the building structure at intervals of not more than sixteen (16) feet, and the weight of the counterweight for each size of guide rail shall not exceed that specified in Table No. 200.4c(1).

Intermediate tie brackets, approximately equally spaced, shall be provided between the guide rails at intervals as specified in Table No. 200.4c(2).

Intermediate tie brackets are not required to be fastened to the building structure.

EXCEPTIONS: The bracket spacing specified may be increased by an amount determined by Figure Nos. 200.4a(1) and 200.4a(2), subject to the following requirements:

(1) Where guide rails are reinforced or a larger rail section is used having a moment of inertia, about an axis parallel to the base (axis I-I in Figure No. 200.4a(2)), at least equal to that of the rail sections shown in Table No. 200.3, based on the weight of the counterweight; and

(2) Where intermediate tie brackets, approximately equally spaced, are provided between the guide rails at intervals of not over seven (7) feet.

Table No. 200.4b

Load Multiplying Factor For Duplex Safeties

Vertical Distance Between Safeties in Feet	Multiply Load in Figure No. 200.4a(1) By
18 or more	2.0
15	1.83
12	1.67
9	1.50

Table No. 200.4c(1)*

Guide Rails for Counterweights Without Safeties

Weight of Counterweight in Pounds	Nominal Weight of Guide Rail in Pounds Per Foot	Maximum Bracket Spacing Without Reinforcement in Feet
15,000	8	16
27,000	11	16
29,000	12	16
40,000	15	16
56,000	18½	16
80,000	22½	16

Table No. 200.4c(2)

Intermediate Tie Brackets

Nominal Distance Between Fastenings to Building Structure in Feet	Number of Intermediate Tie Brackets
0 to 12	0
12 to 14	1
14 to 16	2

Rule 200.5 Stresses and Deflections

200.5a *Guide Rails.*

The stresses in a guide rail or in the rail and its reinforcement, due to the horizontal forces imposed on the rail during loading, unloading or running, calculated without impact, shall not exceed fifteen thousand (15,000) pounds per square inch based upon the class of loading; and the deflection shall not exceed one-quarter (¼) inch (See Rule 207.2b and Rule 1301.6).

EXCEPTION: Where steels of greater strength than those specified in Rule 200.2a are used, the stresses specified may be increased proportionately based on the ratio of the ultimate strengths.

200.5b *Brackets, Fastenings and Supports.*

The guide rail brackets, their fastenings and supports, such as building beams and walls, shall be capable of resisting the horizontal forces imposed by the class of loading (see Rule 207.2b, and Rule 1301.6) with a total deflection at the point of support not in excess of one-eighth (⅛) inch.

Rule 200.6 Guide Rail Guiding Surfaces

Guide rails shall have finished guiding surfaces.

Rule 200.7 Rail Joints and Fishplates

200.7a *Type and Strength of Rail Joints.*

Metal guide rails shall be joined together by fishplates or by other approved means, as specified in Rule 200.7b, of such design and strength as to withstand the forces specified in Rule 200.5a within the deflection limits specified.

200.7b *Design and Construction of Rail Joints.*

The joints of metal guide rails shall conform to the following requirements:

1 The ends of the rails shall be accurately machined with a tongue and matching groove centrally located in the web.
2 The backs of the rail flanges shall be accurately machined, in relation to the rail guiding surfaces, to a uniform distance front to back of the rails to form a flat surface for the fishplates.
3 The ends of each rail shall be bolted to the fishplates with not fewer than four (4) bolts.
4 The width of the fishplate shall be not less than the width of the back of the rail.
5 The thickness of the fishplates and the diameter of the bolts for each size of guide rail shall be not less than specified in Table No. 200.7b.
6 The diameter of bolt holes shall not exceed the diameter of the bolts by more than one-sixteenth (1/16) inch for guide rails nor one-eighth (⅛) inch for fishplates.

EXCEPTION: Joints of different design and construction to those specified in Rule 200.7b may be used subject to the approval of the enforcing authority, provided they are equivalent in strength and will adequately maintain the accuracy of the rail alignment.

Table No. 200.7b*

Minimum Thickness of Fishplates, And Minimum Diameter of Fastening Bolts

Nominal Weight of Guide Rail in Pounds Per Foot	Minimum Thickness of Fish Plates in Inches	Minimum Diameter of Bolts in Inches
8	9/16	½
11	11/16	⅝
12	11/16	⅝
15	11/16	⅝
18½	13/16	¾
22½	13/16	¾
30	15/16	¾

Rule 200.8 Overall Length of Guide Rails

The top and bottom ends of each run of guide rail shall be so located in relation to the extreme positions of travel of the car and counterweight that the car and counterweight guiding members cannot travel beyond the ends of the guide rails.

Rule 200.9 Guide Rail Brackets and Building Supports

200.9a *Design and Strength of Brackets and Supports.*

The building construction forming the supports for the guide rails, and the guide-rail brackets, shall be of such design as to:

1 Safely withstand the application of the car or counterweight safety when stopping the car and its rated load or the counterweight.

2 Withstand the forces specified in Rule 200.5b within the deflection limits specified.

Where necessary, the building construction shall be reinforced to provide adequate support for the guide rails.

NOTE: Hoistway-enclosure walls of brick, terracotta and similar materials, used in buildings of steel and concrete construction, are usually insufficient in strength to form by themselves adequate supports for the guide rails.

200.9b *Bracket Fastenings.*

Guide-rail brackets shall be secured to their supporting structure by means of bolts, rivets or by welding. Fastening bolts and bolt holes in brackets and their supporting beams shall conform to the requirements of Rule 200.10. Welding shall conform to Rule 203.7-c.

Rule 200.10 Fastening of Guide Rails to Rail Brackets

200.10a* *Type of Fastenings.*

Guide rails shall be secured to their brackets by clips, by welding or by bolts.

Bolts used for fastening shall be of such strength as to withstand the forces specified in Rules 200.5b and 200.9a.

Welding, where used, shall conform to Rule 203.7-c.

200.10b *Size of Bolts for Fastenings.*

The size of bolts used for fastening the guide rails or rail clips to the brackets shall be not less than specified in Table No. 200.10b.

Table No. 200.10b*

Minimum Size of Rail-Fastening Bolts

Nominal Weight of Guide Rail in Pounds Per Foot	Minimum Diameter of Bolts in Inches
8	½
11	⅝
12	⅝
15	⅝
18½	⅝
22½	¾
30	¾

200.10c *Bolt Holes for Fastenings.*

The diameter of holes or the width of slots for fastening bolts shall not exceed the diameter of the bolt by more than one-sixteenth (1/16) inch.

Rule 200.11 Information on Elevator Layouts

Elevator layout drawings shall, in addition to other data, indicate the following:

a The bracket spacing.

b The estimated maximum vertical forces on the guide rails on application of the safety device.

c In the case of freight elevators for Class B or C loading (See Rule 207.2b), the horizontal forces on the guide-rail faces during loading and unloading, and the estimated maximum horizontal forces in a post-wise direction on the guide-rail faces on the application of the safety device.

d The size and weight per foot of any rail reinforcements where provided.

SECTION 201 — CAR AND COUNTERWEIGHT BUFFERS

Rule 201.1 Type and Location

201.1a *Spring, Oil, or Equivalent Buffers.*

Buffers of the spring, oil, or equivalent type shall be installed under the cars and counterweights of passenger elevators having a rated speed in excess of fifty (50) feet per minute, and under the cars and counterweights of freight elevators having a rated speed in excess of seventy-five (75) feet per minute.

NOTE: Rule 109.1-b requires buffers under all cars and counterweights in hoistways which are above accessible spaces.

Spring buffers or their equivalent may be used where the rated speed is not in excess of two hundred (200) feet per minute.

Approved oil buffers or their equivalent shall be used where the rated speed is in excess of two hundred (200) feet per minute.

EXCEPTION: Where type C safeties are used (See Rule 205.8b), car buffers are not required provided solid bumpers are installed.

201.1b *Solid Bumpers.*

For rated speeds not exceeding fifty (50) feet per minute for passenger elevators or seventy-five (75) feet per minute for freight elevators, if spring, oil or equivalent-type buffers are not used, solid bumpers shall be installed.

201.1c *Location.*

Buffers or bumpers shall be located symmetrically with reference to the vertical center line of the car frame or the counterweight frame within a tolerance of two (2) inches.

Rule 201.2 Construction and Requirements for Solid Bumpers

Solid bumpers shall be made of wood or other suitable resilient material of sufficient strength to withstand without failure the impact of the car with rated load, or the counterweight, descending at one hundred and fifteen (115) percent of the rated speed.

The material used shall be of a type which will resist deterioration or be so treated as to resist deterioration.

Rule 201.3 Construction and Requirements for Spring Buffers

201.3a *Stroke* (See Definition).

The stroke of the buffer spring, as marked on its marking plate, shall be equal to or greater than the following:

Rated Car Speed Feet Per Minute	Stroke in Inches
100 or less	1½
101 to 150	2½
151 to 200	4

201.3b* *Load Rating* (See Definition).

Buffers for cars and counterweights shall:

1 Be capable of supporting, without being compressed solid, a static load having a minimum of two (2) times the total weight of:
  a The car and its rated load for car buffers.
  b The counterweight for counterweight buffers.

2 Be compressed solid with a static load of three (3) times the weight of:
  a The car and its rated load for car buffers.
  b The counterweight for counterweight buffers.

EXCEPTION: Where Rule 109.1-b2 necessitates a greater load rating.

201.3c *Marking Plate.*

Each spring buffer shall have permanently attached to it a metal plate marked in a legible and permanent manner to show its stroke and load rating.

Rule 201.4 Construction and Requirements for Oil Buffers

201.4a *Stroke.*

The minimum stroke of oil buffers shall be based on the following:

1 The stroke shall be such that the car or the counterweight on striking the buffer at one hundred and fifteen (115) percent of rated speed shall be brought to rest with an average retardation of not more than 32.2 feet per second per second, or

2** Where an emergency terminal speed limiting device is installed which conforms to the requirements of Rule 209.4, and which will limit the speed at which the car or counterweight can strike its buffer, the buffer stroke shall be based on at least one hundred and fifteen (115) percent of such reduced striking speed and on an average retardation not exceeding 32.2 feet per second per second.

In no case shall the stroke used be less than fifty (50) percent of the stroke required by Subdivision 1 of this rule for rated speeds under eight hundred (800) feet per minute, nor less than thirty-three and one third (33-1/3) percent, or eighteen (18) inches, whichever is greater for rated speeds of eight hundred (800) feet per minute or more.

Figure No. 1304.1, in Section 1304, indicates the minimum buffer strokes for various initial velocities. Table No. 201.4a indicates the minimum buffer strokes for the most usual rated speeds. See formula in Section 1304 for calculation of buffer strokes differing from or exceeding those listed in Table 201.4a.

Table No. 201.4a**

Minimum Buffer Strokes

Rated Speed in Feet Per Minute	115% of Rated Speed in Feet Per Minute	Minimum Strokes of Oil Buffers in Inches†**
200	230	2¾
225	259	3½
250	288	4¼
300	345	6¼
350	402	8¼
400	460	11
450	517	13¾
500	575	17
600	690	24¾
700	805	33¼
800	920	43¾
900	1035	55½
1000	1150	68½
1100	1265	83
1200	1380	98½
1300	1495	115½
1400	1610	134½
1500	1725	154

Where buffers of the stroke specified are not provided, the requirements of Rule 201.4a-2 apply.

201.4b *Retardation.*

Oil buffers shall develop an average retardation not in excess of 32.2 feet per second per second, and shall develop no peak retardation greater than 80.5 feet per second per second having a duration exceeding

one twenty-fifth (1/25) of a second with any load in the car from rated load to a minimum load of one hundred and fifty (150) pounds when the buffers are struck with an initial speed of not more than:

1 One hundred fifteen (115) percent of rated speed for buffers conforming with Subdivision 1 of Rule 201.4a, and
2 One hundred fifteen (115) percent of the predetermined reduced speed for buffers conforming with Subdivision 2 of Rule 201.4a.

201.4c *Factor of Safety for Oil-Buffer Parts.*

The factor of safety of parts of oil buffers, based on the yield point for compression members and on the ultimate strength and elongation for other parts, at gravity retardation with the maximum load for which the buffer is designed, shall be not less than the following:

1 Three (3) for materials having an elongation of twenty (20) percent or more in a length of two (2) inches.
2 Three and one-half (3½) for materials having an elongation of from fifteen (15) to twenty (20) percent in a length of two (2) inches.
3 Four (4) for materials having an elongation of from ten (10) to fifteen (15) percent in a length of two (2) inches.
4 Five (5) for materials having an elongation of less than ten (10) percent in a length of two (2) inches, except that cast iron shall have a factor of safety of ten (10).

201.4d *L/R for Members under Compression as Columns.*

The *L/R* ratio of members of oil buffers under compression as columns shall be not more than eighty (80).

The *L/R* ratio specified applies only to those main buffer members which are subject to the impact of the fully loaded car when striking the buffer.

201.4e *Plunger-Return Requirements.*

Oil buffers shall be so designed that:

1 The buffer plunger of gravity-return and spring-return type oil buffers, when the buffer is filled with oil shall, when released after full compression, return to its fully extended position within ninety (90) seconds.
2 The plunger of a spring-return type oil buffer with a fifty (50) pound weight resting on it shall, when released after being depressed two (2) inches, return to the fully extended position within thirty (30) seconds.

201.4f *Means for Determining Oil Level.*

Oil buffers shall be provided with means for determining that the oil level is within the maximum and minimum allowable limits. Glass sight gages shall not be used.

201.4g** *Approval of Oil Buffers.*

Oil buffers shall be approved by the enforcing authority subject to the following:

1 The buffer shall be approved on the basis of the engineering tests specified in Section 1100, made by a qualified testing laboratory or by the manufacturer and witnessed by a representative of such a qualified testing laboratory. Tests shall be made on a buffer of each type or design to be approved and having the following oil portings:

   a The porting having the range of the maximum loads for which the buffer is designed.

   b The porting having the range of the minimum loads for which the buffer is designed.

   The firm or person installing the buffer shall submit to the enforcing authority an authentic copy of the test certificate conforming to the requirements of Rule 1100.5f.

2 Upon receipt of an authentic copy of the test certificate stating that the buffer tested has met the specified test requirements, the enforcing authority shall approve the use of such buffers.

   Oil buffers tested in accordance with the test requirements of prior editions of this code shall be acceptable without being retested, on submittal by the person or firm installing the buffers of the test certificate stating that the buffer, when tested, met the specified test requirements of that edition of the code.

   The approval shall include buffers of the same type or design having a greater or shorter stroke, up to a maximum of seven (7) feet, and having oil portings for any load range within the maximum and minimum loads for which the buffer has been tested, provided that the installer certifies on the plans and specifications filed with the enforcing authority that the buffer as installed will conform to the requirements of Rules 201.4a and 201.4b.

201.4h *Compression of Buffers When Car is Level with Terminal Landings.*

Car and counterweight oil buffers of the spring-return type may be compressed not to exceed twenty-five (25) percent of their stroke when the car is level with the terminal landings (See Rule 107.1b-1).
1).

201.4i* *Buffer Oil Requirements.*

Oils used in oil buffers shall have a pour point of zero (0) degrees F, or lower, as defined in ANSI Z11.5-1966 (ASTM D97-66), and a viscosity index of seventy-five (75) or higher, as defined in ANSI Z11.211-1968 (ASTM D2270-64).

201.4j *Load Ratings of Oil Buffers.*

The minimum and maximum load ratings of car and counterweight oil buffers, as indicated on the buffer marking plate, shall conform to the following:

1 The minimum load rating shall be not greater than:
  a For car oil buffers, the total weight of the car as marked on the car crosshead data plate plus one hundred and fifty (150) pounds.
  b For counterweight oil buffers, the weight of the counterweight used.
2 The maximum load rating shall be not less than:
  a For car oil buffers, the total weight of the car as marked on the crosshead data plate plus the rated load.
  b For counterweight oil buffers, the weight of the counterweight used.

201.4k *Buffer Marking Plate.*

Every installed oil buffer shall have securely attached thereto a metal plate, marked by the manufacturer in a legible and permanent manner, indicating:

1 The maximum and minimum loads and the maximum striking speeds for which the buffer may be used in conformity with this section.
2 The permissible range in viscosity of the buffer oil to be used, stated in Saybolt Seconds Universal at one hundred (100) degrees F.
3 The viscosity index number of the oil to be used.
4 The pour point in degrees Fahrenheit of the oil to be used.

SECTION 202 — COUNTERWEIGHTS

Rule 202.1 General Requirements

202.1a *Frames.*

Counterweight weight sections shall be mounted in structural or formed metal frames so designed as to retain the weights securely in place (See Rule 202.2f).

202.1b *Tie Rods.*

At least two (2) tie rods shall be provided which shall pass through all weight sections. Tie rods shall be provided with lock nuts and cotter pins at each end.

EXCEPTION: Tie rods are not required where other means are provided to retain weight sections in place if they become broken.

202.1c *Guiding Members.*

Counterweight frames shall be guided on each guide rail by upper and lower guiding members attached to the frame.

202.1d *Independent Car Counterweights.*

Where an independent car counterweight is provided, it shall run in separate guide rails and shall not be of sufficient weight to cause undue slackening of the hoisting ropes during acceleration or retardation of the elevator car.

Rule 202.2 Design Requirements for Frames and Rods

202.2a *Material.*

Frames and rods shall be made of steel or other metals conforming to the requirements of Rules 203.6b and 203.6c, provided that where steels of greater strength than those specified, or where metals other than steel are used, the factor of safety used in the design shall conform to the requirements of Rule 202.2c.

202.2b *Frame Connections.*

Connections between frame members shall conform to Rule 203.7.

202.2c *Factor of Safety.*

The frame members and their connections shall be designed with a factor of safety of not less than five (5) with the elevator at rest and the counterweight at the top of its travel.

202.2d *Sheaves.*

Where a hoisting sheave or sheaves are mounted in the frame, the requirements of Rule 203.12 shall apply (See also Rules 208.2 and 208.3 for requirements for sheaves).

202.2e *Suspension-Rope Hitch or Shapes.*

Where counterweights are suspended by ropes attached directly to the frames by means of rope fastenings, the rope attachments shall conform to Rule 203.13.

202.2f *Securing of Weights in Frames.*

The weights shall be so mounted and secured in the frames as to prevent shifting of the weights by an amount which will reduce the running clearances to less than those specified in Rule 108.1b.

Rule 202.3 Cars Counterbalancing One Another

An elevator car shall not be used to counterbalance another elevator car.

Rule 202.4* Compensating Chain or Rope Fastenings

Compensating chains or ropes shall be fastened to the counterweight frame directly or to a bracket fastened to the frame and shall not be fastened to the tie rods.

When compensating ropes are used with a tension sheave, one end of each rope shall be provided with a shackle-rod, or other means which provide for individual adjustment of rope length.

SECTION 203 — CAR FRAMES AND PLATFORMS

Rule 203.1* Car Frames Required

Every elevator shall have a car frame. (See Definition)

Rule 203.2 Guiding Members

Car frames shall be guided on each guide rail by upper and lower guiding members attached to the frame.

Rule 203.3 Design of Car Frames and Guiding Members

The frame and its guiding members shall be designed to withstand the forces resulting under the loading conditions for which the elevator is designed (See Section 207).

Rule 203.4* Underslung or Sub-Post Frames

The vertical distance between the center lines of the top and bottom guide shoes of an elevator car having a sub-post car frame or having an underslung car frame located entirely below the car platform, shall be not less than forty (40) percent of the distance between guide rails.

Rule 203.5 Car Platforms

Every elevator car shall have a platform consisting of a nonperforated floor attached to a platform frame supported by the car frame, and extending over the entire area within the car enclosure. The platform-frame members and the floor shall be designed to withstand the forces developed under the loading conditions for which the elevator is designed and installed.

Rule 203.6 Materials for Car Frames and Platform Frames

203.6a *Materials Permitted.*

Materials used in the construction of car frames and platforms shall conform to the following:

1 Car frames and outside member of platform frames shall be made of steel or other metals.
2 Platform stringers of freight elevators designed for Class B or C loading shall be of steel or other metals.
3 Platform stringers of passenger elevators and of freight elevators designed for Class A loading shall be made of steel or other metals, or of wood.
4 Cast iron shall not be used for any part subject to tension, torsion or bending.

EXCEPTIONS:
(1) Guiding supports.
(2) Guide shoes.
(3) Compensating rope anchorages.

203.6b *Requirements for Steel.*

Steel used in the construction of car frames and platforms shall conform to the following requirements:

1** Car-Frame and Platform-Frame Members. Steel shall be rolled, formed, forged or cast, conforming to the requirements of the following specifications of the American Society for Testing and Materials:
  a Rolled and Formed Steel, ASTM A36-67 or ASTM A283-67 Grade D.
  b Forged Steel, ASTM 235-67 Class C.
  c Cast Steel, ANSI G50.1-1967 (ASTM A27-65) Grade 60/30.

2* Rivets, Bolts, and Rods. Steel used for rivets, bolts and rods shall conform to the following specifications of the American Society for Testing and Materials:
  a Rivets, ASTM A502-65.
  b Bolts and Rods, ASTM A307-67.

EXCEPTION: Steels of greater strength than those specified may be used provided they have an elongation of not less than twenty-two (22) percent in a length of two (2) inches, and provided that the stresses and deflections conform to the requirements of Rules 203.10 and 203.11 respectively.

203.6c *Requirements for Metals other than Steel.*

Metals other than steel may be used in the construction of car frames and platforms provided the metal used has the essential properties to meet all the requirements for the purpose in accordance with good engineering practice, and providing the stresses and deflections conform to the requirements of Rules 203.10 and 203.11 respectively.

203.6d *Requirements for Wood for Platform Floors and Stringers.*

Wood used for platform stringers and for platform floors and sub-floors shall be of clear structural quality lumber conforming to the requirement of the following specifications of the American Society for

Testing and Materials:

1* Structural Grades of Lumber, ANSI 04.3-1969 (ASTM D245-64T).
2* Static Tests of Structural Timbers, ASTM D198-67.

Rule 203.7 Car-Frame and Platform Connections

Connections between members of car frames and platforms shall be riveted, bolted or welded, and shall conform to the following:

a** Bolts. Bolts, where used through greater than five (5) degrees sloping flanges of structural members, shall have boltheads of the tipped-head type or shall be fitted with beveled washers.

b** Nuts. Nuts, used on greater than five (5) degrees sloping flanges of structural members, shall seat on beveled washers.

c Welding. Welding of parts upon which safe operation depends shall be done in accordance with the appropriate standards established by the American Welding Society.

All welding of such parts shall be done by welders qualified in accordance with the requirements of the American Welding Society. At the option of the manufacturer, the welders may be qualified by one of the following:

1 By the manufacturer.
2 By a professional consulting engineer.
3 By a recognized testing laboratory.

EXCEPTION: Tack welds not later incorporated into finished welds carrying calculated loads.

Rule 203.8 Protection of Platforms Against Fire

The underside of wood platforms and the exposed surfaces of wood platform stringers of passenger elevators shall be protected against fire by one of the following methods:

a By covering with sheet steel of at least No. 27 U.S. gage or with equally fire-retardant material.

b* By painting with an approved fire-retardant paint having a flame spread rating of not over fifty (50), applied in accordance with the instructions of the manufacturer. Such ratings shall be based on the test procedure specified in ANSI A2.5-1963 (ASTM E84-61).

Rule 203.9 Platform Guards (Aprons)

The entrance side of the platform of passenger and freight elevators equipped with leveling devices or truck-zoning devices shall be provided with smooth metal guard plates of not less than No. 16 U.S. gage steel, or material of equivalent strength and stiffness, adequately reinforced and braced to the car platform and conforming to the following:

a It shall extend not less than the full width of the widest hoistway-door opening.
b* It shall have a straight vertical face, extending below the floor surface of the platform, of not less than the depth of the leveling or truck zone, plus three (3) inches.
c The lower portion of the guard shall be bent back at an angle of not less than sixty (60) degrees nor more than seventy-five (75) degrees from the horizontal.
d The guard plate shall be securely braced and fastened in place to withstand a constant force of not less than one-hundred fifty (150) pounds applied at right angles to and at any position on its face without deflecting more than one-quarter (¼) inch, and without permanent deformation.

Where the car entrance on the truck-loading side is provided with a collapsible-type gate and the height of the hoistway door opening is greater than the distance from the car floor to the car top, a head guard extending the full width of the door opening shall be provided on the car to close the space between the car top and the soffit of the hoistway-door opening when the car platform is level with the floor at the truck-loading landing entrance.

Rule 203.10 Maximum Allowable Stresses in Car-Frame and Platform Members and Connections

The stresses in car-frame and platform members and their connections based on the static load imposed upon them, shall not exceed the following:

a For steels meeting the requirements of Subdivisions 1 and 2 of Rule 203.6b, as listed in Table 203.10.
b For steels of greater strength, as permitted by the Exception to Rule 203.6b, the stresses listed in Table 203.10 may be increased proportionately based on the ratio of the ultimate strengths.
c For metals other than steel, as permitted by Rule 203.6c, the factor of safety shall be not less than is required for steel as listed in Subdivisions 1 and 2 of Rule 203.6b, based on the allowable stress specified in Table 203.10.

Rule 203.11 Maximum Allowable Deflections of Car-Frame and Platform Members

The deflections of car-frame and platform members based on the static load imposed upon them shall be not more than the following:

a For crosshead, 1/960th of the span.
b For plank, 1/960th of the span.

c For uprights (stiles), as determined by Rule 1301.5-c.
d For platform-frame members, 1/960th of the span.

NOTE: The above deflection limits apply irrespective of the type of steel or other metal used.

Table No. 203.10

Maximum Allowable Stresses in Car-Frame and Platform Members and Connections, for Steels Specified in Subdivisions 1 and 2 of Rule 203.6B

Member	Type of Stress	Max Stress psi	Area Basis
Car Crosshead	Bending	12,500	Gross Section
Car-Frame Plank Normal Loading	Bending	12,500	Gross Section
Car-Frame Plank Buffer Reaction	Bending	25,000	Gross Section
Car-Frame Uprights (Stiles)	Bending plus	15,000	Gross Section
	Tension	18,000	Net Section
Hoisting-Rope Hitch Plates & Shapes	Bending plus Tension	8,000	Net Section
Platform Framing	Bending	12,500	Gross Section
Platform Stringers	Bending	15,000	Gross Section
Threaded Brace Rods & other Tension Members Except Bolts	Tension	8,000	Net Section
Bolts	Tension	7,000	Net Section
Bolts in Clearance Holes	Shear	7,000	Actual Area in Shear Plane
Bolts in Clearance Holes	Bearing	16,000	Gross Section
Rivets or Tight Body-fit Bolts	Shear	10,000	Actual Area in Shear Plane
Rivets or Tight Body-fit Bolts	Bearing	18,000	Gross Section
Any Framing Member, Normal Loading	Compression	$14,000 - \frac{59L}{R}$	Gross Section

Rule 203.12 Car Frames with Crosshead Sheaves

Where a hoisting-rope sheave is mounted on the car frame, the construction shall conform to the following:

a Where multiple sheaves mounted on separate sheave shafts are used, provision shall be made to take the compressive forces, developed by tension in the hoist ropes between the sheaves, on a strut or struts between the sheave-shaft supports, or by providing additional compressive strength in the car frame or car-frame members supporting the sheave shafts.

b Where the sheave shaft extends through the web of a car-frame member, the reduction in area of the member shall not reduce the strength of the member below that required. Where necessary, reinforcing plates shall be welded or riveted to the member to provide the required strength. The bearing pressure shall in no case be more than that permitted in Table 203.10 for bolts in clearance holes.

c Where the sheave is attached to the car crosshead by means of a single threaded rod or specially designed member or members in tension, the following requirements shall be conformed to:

1 The single rod, member or members, in tension shall have a factor of safety fifty (50) percent higher than the factor of safety required for the suspension wire ropes, but in no case shall have a factor of safety of less than fifteen (15).

2 The means for fastening the single threaded rod, member or members, in tension to the car frame shall conform to Rule 203.13.

Rule 203.13 Hoisting-Rope Hitch Plates or Shapes

Where cars are suspended by hoisting ropes attached to the car frame by means of rope shackles, the shackles shall be attached to steel hitch plates or to structural or formed steel shapes. Such plates or shapes shall be secured to the underside or to the webs of the car-frame member with bolts, rivets or welds so located that the tensions in the hoisting ropes will not develop direct tension in the bolts or rivets. The stresses shall not exceed those permitted by Rule 105.3c.

Rule 203.14 Calculation of Stresses in Car-Frame and Platform-Frame Members

The calculation of the stresses and deflections in the car-frame plank and uprights, and platform frames, shall be based on the formulas and data in Section 1301.

Rule 203.15 Platform Side Braces

Where side bracing and similar members are attached to car-frame uprights, the reduction in area of the upright shall not reduce the strength of the upright below that required by this section.

Rule 203.16 Hinged Platform Sills

Hinged platform sills shall conform to the following requirements:

a They shall be provided with electric contacts conforming to Rule

111.5, which will prevent operation of the elevator by the normal operating device unless the hinged sill is within two (2) inches of its fully retracted position, provided that when in this position, the sill shall not reduce the clearance specified in Rule 108.1d.

b The elevator may be operated by the leveling device in the leveling zone with the sill in any position.

c The strength of the sills shall conform to the requirements of Rule 110.11a.

SECTION 204 — CAR ENCLOSURES, CAR DOORS AND GATES, AND CAR ILLUMINATION

Rule 204.1 Passenger and Freight Enclosures, General

204.1a *Extent of Enclosures.*

Elevator cars shall be permanently enclosed on all sides, except the sides used for entrance and exit, and on the top.

204.1b *Securing of Enclosures.*

The enclosure shall be securely fastened to the car platform and so supported that it cannot loosen or become displaced in ordinary service or on the application of the car safety or on buffer engagement.

204.1c *Deflection of Enclosure Walls.*

The enclosure walls shall be of such strength and so designed and supported that when subjected to a pressure of seventy-five (75) pounds applied horizontally at any point on the walls of the enclosure, the deflection will not reduce the running clearance below the minimum specified in Rule 108.1, nor to exceed one (1) inch.

204.1d *Number of Compartments in Passenger and Freight Elevator Cars.*

Cars shall have not more than one (1) compartment.

EXCEPTIONS: Passenger elevators or freight elevators may have two compartments, one of which is located immediately above the other provided the comparmented elevator conforms to the following requirements:

(1) The elevator shall be used exclusively for passengers or exclusively for freight at any one time.

(2) Each compartment shall conform to the requirements of this section except that a trap door in the floor of the upper comparment shall provide access to the top emergency exit for the lower compartment.

(3) Where either or both compartments are intended for passenger service, the minimum rated load for each compartment shall conform to the requirements of Rule 207.1. Where one compartment is intended for freight use, its minimum rated load shall conform to the requirements of Rule 207.1 or shall be based on the freight loads to be handled, if greater than the minimum rated load required by Rule 207.1.

Where both compartments are used exclusively for freight, the minimum rated load of each compartment shall conform to the requirements of Rule 207.2.

The rated load of the elevator shall be the sum of the rated loads of the individual compartments.

(4) An emergency stop switch conforming to the requirements of Rule 210.2-e shall be provided in each compartment and these emergency stop switches shall be so connected that the car cannot run unless both are in the run position.

(5) All hoistway doors shall be closed and locked and the car doors for each compartment closed before the car can be operated.

204.1e *Top Emergency Exits.*

An emergency exit with a cover shall be provided in the top of all elevator cars and shall conform to the following requirements:

1 The exit opening shall have an area of not less than four hundred (400) square inches, and shall measure not less than sixteen (16) inches on any side.

2 The exit shall be so located as to provide a clear passageway unobstructed by fixed elevator equipment located in or on top of the car.

3* The exit cover shall open outward and shall be hinged or otherwise attached to the car top and so arranged that the cover can be opened from the top of the car only.

204.1f *Car-Enclosure Tops.*

Tops of car enclosures shall be so designed and installed as to be capable of sustaining a load of three hundred (300) pounds on any square area two (2) feet on a side and one hundred (100) pounds applied at any point. Simultaneous application of these loads is not required.

204.1g *Equipment Prohibited on Top of Cars.*

A working platform or equipment which is not required for the operation of the elevator or its appliances, except where specifically provided herein, shall not be located above the top of an elevator car.

204.1h** *Uses of Glass in Elevator Cars.*

Glass may be used in elevator cars. Glass exceeding one (1) square foot in area shall:

1 Be laminated.

2 Meet the requirements for laminated glass of ANSI Z97.1-1966 except as to transparency.

3 Be installed and guarded so as to provide adequate protection for passengers in case the glass panels break or are dislodged.

4 Be so mounted in the structure that the structure including the glass in place shall withstand the required elevator tests without damage.

204.1i *Equipment Prohibited Inside Cars.*

Apparatus or equipment, other than that used in connection with the operation of the elevator, shall not be installed inside any elevator car.

EXCEPTIONS:
(1) Railroad and conveyor tracks in freight elevators.
(2) Lighting, heating, ventilating and air-conditioning equipment (See Rule 102.1a).

Rule 204.2 Passenger-Car Enclosures

204.2a *Material for Enclosures and Enclosure Linings.*

Materials for car enclosures and car-enclosure linings shall conform to the following:

1 Material for enclosures shall be:
  a Metal.
  b Fire-retardant-treated wood.
  c Other equally fire retardant approved material.

EXCEPTION: Non-fire-retardant treated wood or materials of equivalent combustible characteristics may be used if all exterior surfaces of the enclosure are covered with sheet metal not less than No. 27 U.S. gage or other equally fire retardant material or are protected by painting with an approved fire-retardant paint having a flame spread rating of not over 50, applied in accordance with the instructions of the manufacturer. Such ratings shall be based on the test procedure specified in ANSI A2.5-1963 (ASTM E84-61).*

2 Slow-burning combustible materials for insulating, sound deadening or decorative purposes may be used for lining enclosures if firmly bonded flat to the enclosure. Such materials shall not be padded or tufted.

*EXCEPTION:** Padded protective linings used temporarily in passenger cars during the handling of freight, provided the pads are made of fire retardant material or treated with an acceptable fire retardant. The fire retardant treatment shall be renewed as needed. The protective linings shall clear the floor of the car by not less than four (4) inches.*

204.2b *Openings Prohibited.*

Openings or hinged or removable panels in an enclosure, other than as required for signal, operating or communication equipment, entrance, vision panels, emergency exit and ventilation, are prohibited.

EXCEPTION: Access panels for maintenance of equipment when approved by the enforcing authority. Such panels, where provided, shall conform to Subdivisions 1, 2, 5, 6, and 7 of Rule 204.2d except that they are not required to be openable from the outside.

204.2c* *Ventilation.*

Where car doors are used, means for ventilation shall be provided. Vent openings, where used, shall not be located in the portion of the enclosure walls extending from a point one (1) foot above the floor to a point six (6) feet above the floor. Vent openings less than one (1) foot above the floor shall reject a ball one (1) inch in diamenter. Vent openings above the six (6) foot level shall reject a ball two (2) inches in diameter. Ventilating fans or blowers, if used, shall be securely fastened

in place and located above the car ceiling or outside the enclosure.

204.2d *Side Emergency Exits.*

Where there is an elevator located in an adjacent hoistway and the distance between the car platforms does not exceed two (2) feet six (6) inches and where there are no intervening hoistway partitions, counterweights or any fixed obstructions, other than separator beams between the cars, a side emergency-exit door shall be provided in each such adjacent car.

Side emergency-exit doors shall:

1 Be of the hinged type.
2 Open only into the car.
3 Extend from the floor or base moulding to a clear height of not less than five (5) feet and shall have a width sufficient to provide not less than fourteen (14) inches of clear passageway when the door is open.
4 Be so located as to provide free passageway and so that passage of persons is not obstructed by hoisting or counterweight ropes, car-frame members, or by fixed elevator equipment.
5 Be provided with a lock so arranged that the door may be opened from inside the car only by a special-shaped removable key, and from outside the car by a non-removable handle. Locks shall be so designed that they cannot be opened from the inside by the use of ordinary tools or instruments. There shall be no obstruction on the inside of the enclosure which will prevent opening of the door from either side.
6 Be provided with car-door electric contacts conforming to Rule 111.5, and so located as to be inaccessible from the inside of the car.
7 Be of the same material and construction as required for the enclosure.

Keys for unlocking side emergency-exit door locks shall be kept on the premises by the person responsible for the maintenance and operation of the elevator in a location readily available to qualified persons in case of emergency, but where they are unavailable to the general public.

204.2e *Vision Panels.*

Vision panels are not required, but where used shall:

1 Have a total area of not more than one hundred and forty-four (144) square inches, and no single glass panel shall have a width exceeding six (6) inches.
2** Be provided with wired glass or with laminated glass panels conforming to ANSI Z97.1-1966.
3 Be located in the car door or in the front return panel of the car

enclosure.

4 In power-operated car doors, have the inside face of the glass located substantially flush with the inside surface of the door panel.

Rule 204.3 Freight-Car Enclosure

204.3a *Enclosure Material.*

Enclosures shall be of metal without performations to a height of not less than six (6) feet above the floor. Above the six (6) foot level the walls and top of the enclosure shall be metal with or without perforations, except that portion of the enclosure wall in front of and extending six (6) inches on each side of the counterweight which shall be without perforations. Perforated portions of enclosures shall reject a ball one and one-half (1½) inches in diameter.

204.3b *Openings in Car Tops.*

Hinged or removable panels shall not be provided in car tops except for emergency exits.

204.3c *Ventilation.*

If ventilating grilles or louvers are provided in the enclosure below the six (6) foot level, they shall be located not more than one (1) foot above the floor and shall reject a ball two (2) inches in diameter.

Rule 204.4 Passenger and Freight Car Doors and Gates, General Requirements

204.4a *Where Required.*

A door or gate shall be provided at each entrance to the car.

204.4b *Car-Door and Gate Electric Contacts.*

Each door or gate shall be equipped with a car-door or gate electric contact conforming to the requirement of Rule 111.5, so located as to be inaccessible from inside the car.

204.4c *Type and Material for Doors.*

Doors shall be of the horizontally or vertically sliding type and of material conforming to the requirements of Rule 204.2a for passenger elevators and Rule 204.3a for freight elevators.

204.4d *Type of Gates.*

Gates shall be either horizontally sliding collapsible type or vertically sliding type, subject to the requirements of Rules 204.4h, 204.5, and 204.6. Collapsible type gates may be arranged to swing inward when in the fully opened (collapsed) position.

204.4e *Location.*

Doors or gates for automatic or continuous-pressure operation elevators shall be so located that the distance from the face of the car door or gate to the face of the hoistway door shall be not more than the following:

1 Where a swinging-type hoistway door and a car gate are used, four (4) inches.
2 Where a swinging-type hoistway door and a car door are used, five and one-half (5½) inches.
3 Where a sliding-type hoistway door and a car gate or door are used, five and one-half (5½) inches.

The distances specified shall be measured as follows:

1 Where a multi-section car door and multi-section hoistway door are used or where one of these doors is multi-section and the other is single section, between the sections of the car door and the hoistway door nearest to each other.
2 Where a multi-section car door and a swinging-type hoistway door are used, between the hoistway door and the section of the car door farthest from it.
3 Where a car gate is used, between the car gate and that section of the hoistway door nearest to the car gate.

EXCEPTION: Freight elevators not accessible to the general public, located in factories, warehouses, garages, and similar buildings, equipped with horizontally swinging doors.

204.4f *Strength of Doors, Gates and Their Guides, Guide Shoes, Tracks and Hangers.*

Doors and gates and their guides, guide shoes, tracks and hangers shall be so designed, constructed and installed that when the fully closed door or gate is subjected to a force of seventy-five (75) pounds, applied on an area of one (1) foot square at right angles to and approximately at the center of the door or gate, it will not deflect beyond the line of the car sill. When subjected to a force of two hundred and fifty (250) pounds, similarly applied, doors and vertically sliding gates shall not break nor be permanently deformed and shall not be displaced from their guides or tracks. Where multi-section doors or gates are used, each panel shall withstand the forces specified.

204.4g *Location and Guarding of Handles of Manually Operated Collapsible Gates.*

Handles of manually operated collapsible gates nearest the car operating device on elevators operated from the car only shall be so located that the nearest handle will be not more than forty-eight (48) inches from the car operating device when the gate is closed (extended

position), and not more than forty-eight (48) inches above the car floor. Gate handles shall be provided with finger guards.

204.4h *Vertically Sliding Doors and Gates.*

Vertically sliding doors or gates shall conform to the following requirements:

1 They shall be of the balanced counterweighted type or the bi-parting counterbalanced type.
2 Gates shall be constructed of wood or metal, and shall be of a design which will reject a ball two (2) inches in diameter.
3 Doors shall be constructed of material conforming to Rule 204.4c.
4 Doors or gates shall guard the full width of the car-entrance openings, and their height shall conform to the requirements of Rules 204.5 and 204.6.
5 Balanced counterweighted doors or gates may be either single or multiple section, and may slide either up or down to open, subject to the requirements of Rules 204.5c and 204.6d.

204.4i *Weights for Closing or Balancing Doors or Gates.*

Weights used to close or balance doors or gates shall be located outside the car enclosure and shall run in guides or be boxed in. Guides shall be of metal, and the bottom of the guides or boxes shall be so constructed as to retain the weight if the suspension member fails.

204.4j *Suspension Members.*

Suspension members of vertically sliding car doors or gates, and of weights used with car doors or gates, shall have a factor of safety of not less than five (5).

204.4k *Power-Operated and Power-Opened or Closed Doors or Gates.*

The operation of power-operated and power-opened or closed doors or gates shall conform to the requirements of Section 112.

204.4m** *Manual Opening of Car Doors or Gates.*

Car doors or gates shall be so arranged that when the car is stopped and power is cut off, they and the mechanically related hoistway door, if any, may be opened by hand from inside the car. The force required at the edge of sliding doors or gates to open them shall not exceed seventy-five (75) pounds.

Rule 204.5 Passenger Car Doors and Gates

204.5a *Number of Entrances Permitted.*

There shall be not more than two (2) entrances to the car.

EXCEPTION: In existing buildings, where structural conditions make additional openings necessary, they may be provided subject to the approval of the enforcing authority.

204.5b *Type Required.*

Horizontally sliding or vertically sliding doors or vertically sliding gates shall, subject to the restrictions of Rule 204.5c, be provided at each car-entrance opening of automatic-operation elevators, and at any car-entrance opening remote from the operator of elevators having other types of operation.

EXCEPTION: In existing hoistways, where structural conditions do not permit the installation of doors, collapsible type car gates may be provided subject to the approval of the enforcing authority.

204.5c *Vertically Sliding Doors or Gates.*

Vertically sliding doors and vertically sliding gates, where permitted by Rule 204.5b, shall conform to the following requirements:

1 At entrances used by passengers, they shall be:
   a Of the balanced counterweighted type which slide in the up direction to open.
   b Power operated.
2 At entrances used exclusively for freight, they shall be:
   a Of the balanced counterweighted type or the bi-parting counterbalanced type.
   b Manually or power operated.

204.5d *Dimensions of Doors and Gates.*

Doors and gates, when in the fully closed position, shall protect the full width and height of the car-entrance opening.

EXCEPTION: Vertically sliding gates, where permitted by Rule 204.5b, shall extend from a point not more than one (1) inch above the floor to a point not less than six (6) feet above the floor.

204.5e *Openings in Doors.*

There shall be no openings in doors, except for vision panels, if used.

204.5f *Collapsible-Type Gates.*

Collapsible-type Gates, where permitted by Rule 204.5b, shall:

1 When fully closed (extended position) reject a ball three (3) inches in diameter.
2 Not be power opened except as permitted by Rule 112.2a-2.
3 Not be used with power operated vertically sliding hoistway doors.
4 Have at least every fourth vertical member guided at the top and every second vertical member guided at the bottom.

204.5g *Door Panels.*

Door panels shall have a substantially flush surface without recessed or raised moldings.

Rule 204.6 Special Requirements for Freight Elevator Car Doors and Gates

204.6a *Type of Gates.*

Gates shall be either of the horizontally sliding collapsible type or the vertically sliding type, subject to the requirements of Rules 204.6c and 204.6d.

EXCEPTION: For elevators designed for either type B or type C loading (See Rule 207.2b), gates shall be of the vertically sliding type.

204.6b *Dimensions of Doors and Gates.*

Car doors and gates shall protect the full width of the car entrance opening.

Doors when fully closed shall extend from the car floor to a height of not less than six (6) feet above the car floor.

Gates when fully closed against the jamb or sill shall extend from a point not more than one (1) inch above the car floor to a point at least six (6) feet above the car floor.

204.6c *Collapsible-Type Gates.*

Collapsible-type gates shall:

1 When fully closed (extended position) reject a ball four and one-half (4½) inches in diameter.
2 Conform to the requirements of Rule 204.5f-2.
3 Not be used for freight elevators authorized to carry employees (See Rule 207.4).
4 Have at least every fourth vertical member guided at the top and every second vertical member guided at the bottom.

204.6d *Vertically Sliding Doors or Gates.*

Vertically sliding doors or gates shall:

1 Be either of the balanced counterweighted type which slide up or down to open, or of the bi-parting counterbalanced type, and may be manually operated or power operated.
2 Where used on freight elevators authorized to carry employees (See Rule 207.4), conform to the requirements of Rule 204.5, except that gates extending from a point one (1) inch above the floor to a point six (6) feet above the floor may be used in place of doors at car-entrance openings used by employees.

Rule 204.7 Illumination of Cars and Lighting Fixtures

204.7a* *Lights and Illumination Required.*

Cars shall be provided with an electric light or lights conforming to the following:

1 Not less than two (2) lamps shall be provided.
2 The minimum illumination at the landing edge of the car platform when the car and landing doors are open shall be not less than:
  a For passenger elevators — five (5) foot candles.
  b For freight elevators — two and one-half (2½) foot candles.
3 Passenger elevators shall be provided with emergency lighting conforming to the following:
  a The emergency system shall provide some general illumination of the car. The intensity of illumination four (4) feet above the car floor and approximately one (1) foot in front of a car station shall be not less than two tenths (0.2) of a foot candle. Lights shall be automatically turned on in all elevators in service not more than ten (10) seconds after normal lighting power failed. The power system shall be capable of maintaining the above light intensity for a period of at least four (4) hours.
  b Not less than two (2) lamps of approximately equal wattage shall be used.
  c The emergency lighting system shall be checked during the inspection required by Rules 1000.1 and 1001.1.

204.7b *Light Control Switches.*

Light control switches are not required, but if provided they shall:
1 Be located in or adjacent to the operating device in the car.
2 In elevators having automatic operation, be of the key operated type or located in a fixture with a locked cover.

204.7c *Passenger-Car Lighting Devices.*

Glass used for lighting fixtures shall conform with Rule 204.1h. Suspended glass used in lighting fixtures shall be supported by a metal frame secured at not less than three points. Fastening devices shall not be removable from the fixture. Glass shall not be drilled for attachment.

Light troughs supporting wiring raceways and other auxiliary lighting equipment, where used, shall be of metal except where lined with non-combustible materials.

Lighting arrangements using slow-burning combustible materials for diffusing and illumination purposes shall be permitted providing such combustible materials do not come in contact with lighting equipment.

204.7d** *Protection of Light Bulbs and Tubes.*

Light bulbs and tubes shall be suitably protected against accidental breakage.

204.7e** *Glass in Car Lighting Fixtures.*

Glass used in connection with car lighting fixtures shall conform to the requirements of Rule 204.1h.

SECTION 205 — CAR AND COUNTERWEIGHT SAFETIES

Rule 205.1 Where Required and Located

The car of every elevator suspended by wire ropes shall be provided with one or more car safety devices of one of the types identified in Rule 205.5. The safeties shall be attached to the car frame, and one safety shall be located within or below the lower members of the car frame (safety plank).

All car safeties shall be mounted on a single car frame and shall operate only on one pair of guide rails between which the frame is located.

Rule 205.2 Duplex Safeties

Where duplex (two) safeties are provided, the lower safety device shall be capable of developing not less than one-half (½) of the force required to stop the entire car with rated load. (See also Rule 207.8) Duplexed safety devices shall be arranged so as to function approximately simultaneously.

Type A or type C safety devices (See Rule 205.5) shall not be used in multiple (duplexed).

Rule 205.3* Function and Stopping Distance of Safeties

The safety device, or the combined safety devices where furnished, shall be capable of stopping and sustaining the entire car with its rated load from governor tripping speed. (See also Rule 207.8).

Type B safeties shall stop the car with its rated load from governor tripping speed within the range of the maximum and minimum stopping distances as determined by the formulas in Section 1306, Table No. 205.3 and Figures 1306.1 (I) through 1306.1 (IV) show the maximum and minimum stopping distances for various governor tripping speeds, when tested in conformance with Rule 1000.2.

Rule 205.4 Counterweight Safeties

Counterweight safeties where furnished (See Rule 109.1) shall conform to the requirements for car safeties.

EXCEPTIONS:

(1) Where otherwise specified in Section 205.

(2) For rated speeds of not over one hundred and fifty (150) feet per minute, counterweight safeties may be operated as a result of the breaking or slackening of the suspension ropes and may be of the inertia or other approved type without governors (See Rules 205.7 and 206.1).

Table No. 205.3

Maximum and Minimum Stopping Distances Type B Car Safeties With Rated Load, and of Type B Counterweight Safeties

Rated Speed in Feet Per Minute	Maximum Governor Trip Speed in Feet Per Minute	Stopping Distances in Feet — Inches Minimum*	Maximum
0 to 125	175	0—1	1—3
150	210	0—2	1—4
175	250	0—3	1—7
200	280	0—4	1—10
225	308	0—5	2—0
250	337	0—6	2—3
300	395	0—8	2—9
350	452	0—10	3—4
400	510	1—1	4—0
450	568	1—5	4—10
500	625	1—8	5—8
600	740	2—4	7—7
700	855	3—2	9—10
800	970	4—1	12—6
900	1085	5—1	15—3
1000	1200	6—3	18—6
1100	1320	7—6	22—4
1200	1440	8—11	26—4
1300	1560	10—6	30—11
1400	1680	12—2	35—7
1500	1800	14—0	40—10

Rule 205.5 Identification and Classification of Types of Safeties

Car safety devices (safeties) are identified and classified on the basis of performance characteristics after the safety begins to apply pressure on the guide rails. On this basis, there are three types of safeties:

a Type A Safeties. Safeties which develop a rapidly increasing pressure on the guide rails during the stopping interval, the stopping distance being very short due to the inherent design of the safety. The operating force is derived entirely from the mass and the motion of the car or the counterweight being stopped. These safeties apply pressure on the guide rails through eccentrics, rollers or similar devices, without any flexible medium purposely introduced to limit the retarding force and increase the stopping distance.

b Type B Safeties. Safeties which apply limited pressure on the guide rails during the stopping interval, and which provide stopping

distances that are related to the mass being stopped and the speed at which application of the safety is initiated. Retarding forces are reasonably uniform after the safety is fully applied. Continuous tension in the governor rope may or may not be required to operate the safety during the entire stopping interval. Minimum and maximum distances are specified on the basis of governor tripping speed (See Rule 205.3).

c Type C Safeties (Type A with Oil Buffers). Safeties which develop retarding forces during the compression stroke of one or more oil buffers interposed between the lower members of the car frame and a governor-operated type A auxiliary safety plank applied on the guide rails. The stopping distance is equal to the effective stroke of the buffers.

Rule 205.6 Safeties to Stop Ascending Cars or Counterweights Prohibited

Safeties shall not stop an ascending car or counterweight.

Rule 205.7 Governor-Actuated Safeties and Car-Safety-Mechanism Switches Required

Car safeties, and counterweight safeties, where provided, shall be actuated by separate speed governors.

EXCEPTION: Speed governors are not required for the operation of counterweight safeties of elevators having a rated speed of not more than one hundred and fifty (150) feet per minute.

Every car safety shall be provided with a switch, operated by the car safety mechanism. This switch shall conform to the requirements of Rule 206.4.

Rule 205.8 Limits of Use of Various Types of Safeties

205.8a *Type A (Instantaneous) Safeties.*

Type A safeties may be used on elevators having a rated speed of not more than one hundred and fifty (150) feet per minute.

When overspeed occurs, with the hoisting ropes intact, such safeties shall be actuated by the governor.

On the parting of the hoisting ropes (free fall), type A governor operated safeties shall apply without appreciable delay, and their application shall be independent of the speed action of the governor and of the location of the break in the hoisting ropes (inertia application), and may be accomplished by the use of a governor and governor rigging having a sufficiently high value of inertia to apply the safety on free fall independently of the speed action of the governor (See Rule 1000.2b for inertia-application test of car safety).

205.8b *Type C (Combination Instantaneous and Oil-Buffer Safety).*
Type C safeties may be used subject to the following requirements:
1 The rated speed shall be not more than five hundred (500) feet per minute.
2 The oil buffers shall conform to all requirements specified in Section 201 for oil buffers, except that the stroke shall be based on governor tripping speed and on an average retardation not exceeding 32.2 feet per second per second.
3 After the buffer stroke, as defined in Subdivision 2, has been completed, provision shall be made for an additional travel of the plunger or piston of not less than ten (10) percent of the buffer stroke to prevent excessive impact on the buffer parts and the auxiliary safety plank.
4 Where the distance between guide rails exceeds eight (8) feet, the safety shall be provided with two oil buffers of substantially identical calibration, and the buffers shall be so located as to develop minimum stresses in the auxiliary safety plank during safety operation.

Buffers shall be located in line with and symmetrically between the guide rails.
5 The auxiliary safety plank shall be so supported and guided below the car frame that the clearances specified in Rule 205.10 for the safety parts are maintained during normal operation.

The auxiliary safety plank shall be so designed that the maximum stresses in the plank shall not exceed those specified for similar car-frame members in Section 203.
6 The rail-gripping device of the auxiliary safety plank shall be so arranged and connected as to prevent the plank from being out of level more than one-half (½) inch in the length of the plank when the safety is operated to stop the car.
7 An electric switch shall be provided and so arranged and connected that the elevator cannot be operated by means of the normal operating device if any buffer is compressed more than ten (10) percent of its stroke.
8 Means shall be provided to prevent operation of the elevator by means of the normal operating device if the oil level in any buffer is below the minimum allowable level.

Rule 205.9 Application and Release of Safeties

205.9a *Means of Application.*
Safeties shall be applied mechanically. Electric, hydraulic, or pneumatic devices shall not be used to apply the safeties required by this Section, nor to hold such safeties in the retracted position.

205.9b *Level of Car on Safety Application.*

The application of the safety to stop the car, with its rated load centered on each quarter of the platform symmetrically with relation to the center lines of the platform, shall not cause the platform to be out of level more than three-eighths (3/8) of an inch per foot in any direction.

EXCEPTION: Type C safeties (See Rule 205.8b(6).

205.9c *Release.*

When car safeties are applied, no decrease in tension in the governor rope nor motion of the car in the down direction shall release the safeties, but such safeties may be released by the motion of the car in the up direction.

205.9d *Force Providing Stopping Action to be Compressive.*

Safeties shall be so designed that on their application the forces which provide the stopping action shall be compressive forces on each side of the guide-rail section.

Rule 205.10* Minimum Permissible Clearance Between Rail-Gripping Faces of Safety Parts

In the normally retracted position of the safety, the distance between the rail-gripping faces of the safety parts shall be not less than the thickness of the guide rail plus 0.14 (9/64) inch; and the clearance on any side between the gripping face and the guide rail shall be not less than 0.0625 (1/16) inch as measured on the side of the rail toward which the car frame is pressed with sufficient force to take up all clearances in the guide-shoe assembly. Safety jaws, while in the retracted position, shall be so restrained as to prevent a reduction of this minimum clearance.

Rule 205.11 Maximum Permissible Movement of Governor Rope to Operate the Safety Mechanism

For all type B safeties the movement of the governor rope, relative to the car or the counterweight respectively, required to operate the safety mechanism from its fully retracted position to a position where the safety jaws begin to exert pressure against the guide rails, shall not exceed the following values based on rated speed:

a For Car Safeties.

200 feet per minute or less — forty-two (42) inches
201 to 375 feet per minute — thirty-six (36) inches
Over 375 feet per minute — thirty (30) inches

b For Counterweight Safeties.

All speeds — forty-two (42) inches

Drum-operated car and counterweight safeties, requiring continual unwinding of the safety drum rope to fully apply the safety, shall be so designed that not less than three (3) turns of the safety rope will remain on the drum after the over-speed test of the safety has been made with rated load in the car (See Rules 1000.2d and 1001.2).

Rule 205.12 Minimum Factors of Safety and Stresses of Safety Parts and Rope Connections

Parts of safeties, except springs, shall have a factor of safety of not less than three and one-half (3.5); and the materials used shall have an elongation of not less than fifteen (15) percent in a length of two (2) inches. Forged, cast, or welded parts shall be stress relieved.

EXCEPTION: Safety-rope drums, leading sheaves, and their supporting brackets and safety-jaw gibs, may be made of cast iron and other metals provided such parts have a factor of safety of not less than ten (10).

Rope used as a connection from the safety to the governor rope, including rope wound on the safety-rope drum, shall be not less than three-eighths (⅜) inch diameter and shall be made of a corrosion-resistant metal. Tiller-rope construction shall not be used. The factor of safety of the rope shall be not less than five (5).

The factors of safety shall be based upon the maximum stresses developed in the parts during the operation of the safety when stopping rated load from governor tripping speed.

Springs may be used in the operation of car or counterweight safeties. Where used, and where partially loaded prior to safety operation, the loading on the spring shall not produce a fibre stress exceeding one-half (½) the elastic limit of the material. During operation of the safety, the fibre stress shall not exceed eighty-five (85) percent of the elastic limit of the material. Helical springs, where used, shall be in compression.

Safety-rope leading-sheave brackets and other safety operating parts shall not be attached to or supported by wood platform members.

Rule 205.13 Corrosion-Resistant Bearings in Safeties and Safety Operating Mechanism

Bearing in safeties and of the safety operating mechanism shall be of corrosion-resistant construction with one or both members of a bearing made of, or electro-plated with, a corrosion-resistant material.

Rule 205.14 Marking Plates for Safeties

A metal plate shall be securely attached to each safety so as to be

readily visible, and shall be marked in a legible and permanent manner with letters and figures not less than one-quarter (¼) inch in height indicating the following:

1 The type of safety based on Rule 205.5.
2 The maximum tripping speed in feet per minute for which the safety may be used.
3 The maximum weight in pounds which the safety as installed is designed to stop and sustain.

Rule 205.15 Governor-Rope Releasing Carriers

The governor-rope releasing carrier on the car (or on the counterweight) shall be set to require a tension in the governor rope, to pull the rope from the carrier, of not more than sixty (60) percent of the pull-through tension developed by the governor; and the carrier shall be designed so that the pull-out tension cannot be adjusted in a normal manner to exceed the amount specified.

Rule 205.16 Rail Lubricants and Lubrication Plate

Rail lubricants or coatings which will reduce the holding power of the safety or prevent its functioning as required in Rule 205.3 shall not be used (See also Rule 1002.1c).

Where lubricants are to be used, a metal plate shall be securely attached to the car crosshead in an easily visible location, and shall carry the notation, "CONSULT MANUFACTURER OF THE SAFETY FOR THE CHARACTERISTICS OF THE RAIL LUBRICANT TO BE USED." If lubricants are not to be used, the plate shall so state.

If lubricants other than those recommended by the manufacturer are used, a safety test shall be made to demonstrate that the safety will function as required by Rule 205.3.

Rule 205.17 Compensating Rope Tie-Down**

For rated speeds greater than seven hundred (700) feet per minute, a device shall be provided to tie the car and counterweight together to limit the jump of the car or counterweight as a result of buffer engagement or application of car or counterweight safety.

SECTION 206 — SPEED GOVERNORS

Rule 206.1 Speed Governors Required and Location

Car safeties, and counterweight safeties where furnished, shall be actuated by separate speed governors.

EXCEPTION: Speed governors are not required for the operation of safeties of counterweights of elevators having a rated speed of not more than one hundred and fifty (150) feet per minute (See Rules 205.4 and 205.7).

The governor shall be located where it cannot be struck by the car or the counterweight in case of overtravel, and where there is adequate space for full movement of governor parts.

Rule 206.2 Tripping Speeds for Speed Governors

206.2a *Car Speed Governors.*

Speed governors for car safeties shall be set to trip at overspeeds as follows:

1 At not less than one hundred and fifteen (115) percent of rated speed.
2 At not more than the tripping speed listed opposite the applicable rated speed in Table No. 206.2a. Maximum tripping speeds for intermediate rated speeds shall be determined from Figure No. 1305.1 in Section 1305. For rated speeds exceeding one thousand five hundred (1500) feet per minute, the maximum tripping speeds shall not exceed one hundred and twenty (120) percent of the rated speed.

206.2b *Counterweight Speed Governors.*

Speed governors, where provided for counterweight safeties shall be set to trip at an overspeed greater than, but not more than ten (10) percent above, that at which the car speed governor is set to trip.

Rule 206.3 Sealing and Painting of Speed Governors

Speed governors shall have their means of speed adjustment sealed after test. If speed governors are painted after sealing, all bearing and rubbing surfaces shall be kept free or freed of paint and a hand test made to determine that all parts operate freely as intended. Seals shall be of a type which will prevent readjustment of the governor tripping speed without breaking the seal.

Rule 206.4 Speed-Governor Overspeed and Car-Safety-Mechanism Switches

206.4a* *Where Required.*

A switch shall be provided on the speed governor and operated by the over-speed action of the governor when used with type B and C car safeties of elevators having a rated speed exceeding one hundred and fifty (150) feet per minute. A switch shall be provided on the speed governor when used with a counterweight safety for any car speed.

Every car safety shall be provided with a switch operated by the car safety mechanism when the safety is applied.

These switches shall, when operated, remove power from the driving-machine motor and brake before or at the time of application of the safety.

Table No. 206.2a*

Maximum Speeds in Feet Per Minute at Which Speed Governor Trips and Governor Overspeed Switch Operates

Rated Speed	Max Governor Trip Speed	Max Speed at Which Governor Overspeed Switch Operates, Down NOTE: See exception to Rule 206.4b
0—125	175	175†
150	210	210†
175	250	225
200	280	252
225	308	277
250	337	303
300	395	355
350	452	407
400	510	459
450	568	512
500	625	563
600	740	703
700	855	812
800	970	921
900	1085	1031
1000	1200	1140
1100	1320	1254
1200	1440	1368
1300	1560	1482
1400	1680	1596
1500	1800	1710

† Governor Overspeed Switch not Required on Car Speed Governors.

206.4b *Setting of Speed-Governor Overspeed Switches.*

The setting of the car speed-governor overspeed switch shall conform to the following:

1 For rated speeds more than one hundred and fifty (150) feet per minute, up to and including five hundred (500) feet per minute, the

car speed-governor overspeed switch shall open in the down direction of the elevator at not more than ninety (90) percent of the speed at which the governor is set to trip in the down direction.

2 For rated speeds more than five hundred (500) feet per minute, the car speed-governor overspeed switch shall open in the down direction of the elevator at not more than ninety-five (95) percent of the speed at which the governor is set to trip in the down direction.

3 The switch, when set as specified in either Subdivision 1 or 2 of this Rule, shall open in the up direction at not more than one hundred (100) percent of the speed at which the governor is set to trip in the down direction.

EXCEPTION: The speed-governor overspeed switch may be set to open in the down direction of the elevator at not more than one hundred (100) percent of the speed at which the governor is set to trip in the down direction, subject to the following requirements:

(1) A speed-reducing switch of the manually reset type is provided on the governor which will reduce the speed of the elevator in case of overspeed, and which shall be set to open as specified in (1) and (2) above.

(2) Subsequent to the first stop of the car following the opening of the speed-reducing switch, the car shall remain inoperative until the switch is manually reset.

206.4c *Type of Speed-Governor Overspeed Switches, Speed-Reducing Switches, and Car-Safety-Mechanism Switches Required.*

Switches used to perform the function specified shall be positively opened. Overspeed and speed-reducing switches permitted by the exception to Rule 206.4b and operated by the speed governor shall remain in the open position until manually reset. Switches operated by the car safety mechanism shall be of a type which will not reset unless the car safety mechanism has been returned to the off position.

Rule 206.5 Governor Ropes

206.5a *Material and Factor of Safety.*

Governor ropes shall be of iron, steel, monel metal, phosphor bronze, or stainless steel, of regular-lay construction, and shall be not less than three-eighths (3/8) inch in diameter. Tiller-rope construction shall not be used.

The factor of safety of governor ropes shall be not less than five (5).

206.5b* *Replacement of Existing Governor Ropes.*

Replacement of governor ropes shall be of the same size, material and construction as the rope originally furnished by the elevator manufac-

turer, except that a rope of the same size but of either different material or construction may be employed provided there is conformance with Rule 206.7 and a test is made of the car or counterweight safety and speed governor with the new rope to demonstrate that the safety will function as required by Rule 205.3.

206.5c *Speed-Governor-Rope Clearance.*

During normal operation of the elevator, the governor rope shall run free and clear of the governor jaws, rope guards or other stationary parts.

206.5d* *Splicing Governor Ropes.*

Governor ropes shall not be lengthened or repaired by splicing.

Rule 206.6 Design of Governor-Rope-Grip Jaws for Type B Safeties

Type B car and counterweight safeties shall be actuated by a speed governor equipped with rope-grip jaws which will permit the governor rope to pull through the jaws. The maximum tension in the governor rope to cause it to slip through the governor jaws shall not exceed one-fifth (1/5) of the rated ultimate strength of the rope.

Governor jaws shall be of such shape and minimum length that no appreciable damage to or deformation of the rope shall result from the stopping action of the jaws in operating the car or counterweight safety.

Rule 206.7 Design of Speed-Governor Sheaves and Traction Between Speed-Governor Rope and Sheave

The arc of contact between the governor rope and the governor sheave shall, in conjunction with a governor-rope tension device, provide sufficient traction to cause proper functioning of the governor.

Governor sheave grooves shall have machine-finished surfaces. Governor tension sheaves shall have machine-finished grooves for rated car speeds of more than one hundred and fifty (150) feet per minute. Machined governor sheave grooves shall have a groove diameter of not more than one and one-eighth (1⅛) times the diameter of the governor rope.

The pitch diameter of governor sheaves and governor tension sheaves shall be not less than the product of the diameter of the rope and the applicable multiplier listed as follows, based on the rated speed and the number of strands in the rope:

Rated Speed	Number of Strands	Multiplier
Two hundred (200) feet per minute or less	6	42
Two hundred (200) feet per minute or less	8	30
Over two hundred (200) feet per minute	6	46
Over two hundred (200) feet per minute	8	32

Rule 206.8 Speed-Governor Marking Plate

A metal plate shall be securely attached to each speed governor and shall be marked in a legible and permanent manner with letters and figures not less than one-quarter (¼) inch in height indicating the following:

1 The speed in feet per minute at which the governor is set and sealed to trip the governor-rope-grip jaws.
2 The size, material and construction of the governor rope on which the governor jaws were designed to operate.

SECTION 207 — CAPACITY AND LOADING

Rule 207.1 Minimum Rated Load for Passenger Elevators

The rated load in pounds for passenger elevators shall be based on the inside net platform areas, and shall be not less than shown by Figure No. 1300.1 in Section 1300 (See also Rule 210.11).

The inside net platform areas shall be determined as shown in Figure 207.1. Table No. 207.1 shows the maximum inside net platform areas for the various rated loads.

Passenger elevators and freight elevators permitted by Rule 207.4 to carry employees shall conform to the requirements of Rule 207.8.

207.1a *Use of Partitions for Reducing Inside Net Platform Area.*

Where partitions are installed in elevator cars for the purpose of restricting the platform net area for passenger use, they shall be permanently bolted, riveted or welded in place. Gates, doors or handrails shall not be used for this purpose. Partitions shall be so installed as to provide for approximately symmetrical loading.

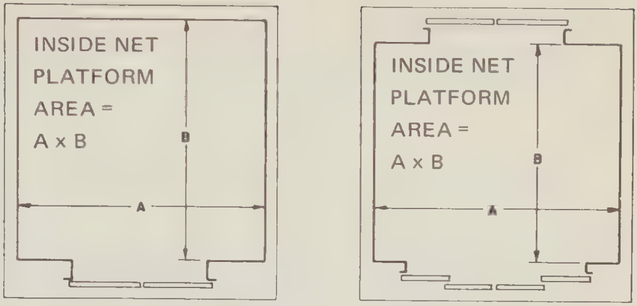


Fig. 207.1 Inside Net Platform Areas for Passenger Elevators

Table No. 207.1

Maximum Inside Net Platform Areas for the Various Rated Loads

Rated Load lb	Inside Net Platform Area sq ft	Rated Load lb	Inside Net Platform Area sq ft
500	7.0	4500	46.2
600	8.3	5000	50.0
700	9.6	6000	57.7
1000	13.25	7000	65.3
1200	15.6	8000	72.9
1500	18.9	9000	80.5
1800	22.1	10000	88.0
2000	24.2	12000	103.0
2500	29.1	15000	125.1
3000	33.7	18000	146.9
3500	38.0	20000	161.2
4000	42.2	25000	196.5
		30000	231.0

207.1b *Carrying of Freight on Passenger Elevators.*

When freight is to be carried on a passenger elevator the following requirements shall be conformed to:

1 The minimum rated load shall conform to the requirements of Rule 207.1 or 207.2, whichever is greater.

2 The elevator shall be designed for applicable class of freight elevator loading.

Rule 207.2 Minimum Rated Load for Freight Elevators

207.2a *Minimum Load Permitted.*

The minimum rated load for freight elevators in pounds shall be based on the weight and class of the load to be handled, but shall in no case be less than the minimum specified in Rule 207.2b for each class of loading based on the inside net platform area.

207.2b *Classes of Loading.*

Freight elevators shall be designed for one of the following classes of loading:

1 Class A — General Freight Loading. Where the load is distributed, the weight of any single piece of freight or of any single hand truck and its load is not more than one-quarter (¼) the rated load of the elevator, and the load is handled on and off the car platform manually or by means of hand trucks.

For this class of loading, the rated load shall be based on not less than fifty (50) pounds per square foot of inside net platform area.

2 Class B — Motor-Vehicle Loading. Where the elevator is used solely to carry automobile trucks or passenger automobiles up to the rated capacity of the elevator.

For this class of loading, the rated load shall be based on not less than thirty (30) pounds per square foot of inside net platform area.

3* Class C — There are three types of Class C loading as follows:

Class C1 — Industrial Truck Loading where truck is carried by the elevator.

Class C2 — Industrial Truck Loading where truck is not carried by the elevator but used only for loading and unloading.

Class C3 — Other Loading with Heavy Concentrations where truck is not used.

These loadings apply where the weight of the concentrated load including an industrial power or hand truck, if used, is more than one-quarter (¼) the rated load and where the load to be carried does not exceed the rated load. (For concentrated loads exceeding the rated load, see Rule 207.6).

The following requirements shall apply to Class C1, Class C2, and Class C3 loadings:

a The rated load of the elevator shall be not less than the load (including any truck) to be carried, and shall in no case be less than load based on fifty (50) pounds per square foot of inside net platform area.

b The elevator shall be provided with a two-way automatic leveling device. (See definition.)

For Class C1 and Class C2 loadings, the following additional requirements shall apply:

c For elevators with rated loads of twenty-thousand (20,000) pounds or less, the car platform shall be designed for a loaded truck of weight equal to the rated load or for the actual weight of the loaded truck to be used, whichever is greater. For elevators with rated loads exceeding twenty-thousand (20,000) pounds, the car platform shall be designed for a loaded truck weighing twenty-thousand (20,000) pounds, or for the actual weight of the loaded truck to be used, whichever is greater.

d** For Class C2 loading, the maximum load on the car platform during loading or unloading shall not exceed one hundred and fifty (150) percent of rated load.

For any load in excess of rated load on elevators with a rated load of twenty-thousand (20,000) pounds or less, the driving machine motor, brake and traction relation shall be adequate to sustain, and level the full one hundred and fifty (150) percent of rated load.

For any load in excess of the rated load on elevators with a rated load exceeding twenty-thousand (20,000) pounds, the driving machine motor, brake and traction relation shall be adequate to sustain, and level the rated load plus either ten thousand (10,000) pounds, or the weight of the unloaded truck to be used, whichever is greater.

NOTE: When the entire rated load is loaded or unloaded by an industrial truck in increments, the load imposed on the car platform while the last increment is being loaded or the first increment unloaded will exceed the rated load by part of the weight of the empty industrial truck.

Rule 207.3 Capacity and Data Plates

207.3a *Plates Required and Location.*

Every elevator shall be provided with a capacity plate and a data plate permanently and securely fastened in place.

Capacity plates shall be located in a conspicuous position inside the car.

Data plates shall be attached to the car crosshead.

EXCEPTION: For underslung elevators having no crosshead, the data plate shall be located inside the car.

207.3b *Information Required on Plates.*

Capacity and data plates shall have the following information:

1 Capacity plates shall indicate the rated load of the elevator in pounds and in addition, this plate or a separate plate shall indicate:
   a The capacity lifting one-piece loads where the elevator conforms to the requirements of Rule 207.7.
   b For freight elevators designed for Class C2 loading, the maximum load the elevator is designed to support while being loaded or unloaded (See Rule 207.2b-3d).

2 Data plates shall indicate:
   a The weight of the complete car including the car safety and all auxiliary equipment attached to the car.
   b The rated load and speed.
   c The wire rope data required by Rule 212.2a.
   d The manufacturer's name and date of installation.

207.3c *Material and Marking of Plates.*

Plates shall be of metal and shall have letters and figures stamped or etched in or cast on the surface of the plate in such a manner as to be readily legible.

The height of the letters and figures shall be not less than:

1 One-quarter (¼) inch for passenger elevator capacity plates.
2 One (1) inch for freight elevator capacity plates.
3 One-eighth (⅛) inch for data plates.

Rule 207.4 Carrying of Passengers on Freight Elevators

Freight elevators shall not be permitted to carry passengers.

EXCEPTIONS:

(1) Elevators not permitted to carry employees may in case of fire, panic or similar emergencies carry passengers not greater in number than the rated load divided by one hundred and fifty (150).

(2) Elevators, not accessible to the general public, may carry employees provided special permission to do so is granted by the enforcing authority, subject to the following conditions:

(a) The rated load of the elevator shall be not less than that required for a passenger elevator of equivalent inside net platform area as required by Rule 207.1.

(b) Hoistway entrances and car doors or gates shall conform to the requirements of the following rules:

(1) Hoistway entrances to Section 110.

(2) Car doors and gates to Rules 204.6c and 204.6d.

Such elevators may carry any class of passengers in case of fire, panic or similar emergencies.

Rule 207.5 Signs Required in Freight Elevator Cars

207.5a *Signs Required.*

Signs, in addition to the capacity and data plates required by Rule 207.3a, shall be provided inside the car and shall be located in a conspicuous position and permanently and securely fastened to the car enclosure subject to the following requirements:

1 In every elevator the sign shall specify the type of loading for which the elevator is designed and installed, with one of the following markings:
   a "THIS ELEVATOR DESIGNED FOR GENERAL FREIGHT LOADING."
   b "THIS ELEVATOR DESIGNED FOR MOTOR-VEHICLE LOADING."
   c "THIS ELEVATOR DESIGNED FOR LOADED INDUSTRIAL TRUCK WEIGHING ______________ LB MAXIMUM."

2 In elevators not permitted to carry passengers, a sign reading: "THIS IS NOT A PASSENGER ELEVATOR, NO PERSONS OTHER THAN THE OPERATOR AND FREIGHT HANDLERS ARE PERMITTED TO RIDE ON THIS ELEVATOR."

3 In elevators permitted to carry employees subject to the requirements of Rule 207.4, a sign reading:
"NO PASSENGERS EXCEPT EMPLOYEES PERMITTED."

207.5b *Material and Marking of Signs.*

The material and marking of all signs shall conform to the requirements of Rule 207.3c, except that the letters shall be not less than one-half (½) inch high.

Rule 207.6 Overloading of Freight Elevators

Freight elevators shall not be loaded to exceed their rated load as specified on the capacity plate required by Rule 207.3.

EXCEPTIONS:

(1) Static loads on elevators loaded and unloaded by industrial trucks as noted on capacity or separate plate. (See Rules 207.2b-3 and 207.3b-1b).

(2) Elevators designed and installed to conform to the requirements of Rule 207.7 to carry one-piece loads exceeding their rated load.

Rule 207.7 Carrying of One-Piece Loads Exceeding the Rated Load

Passenger and freight elevators may be used, where necessary, to carry one-piece loads greater than their rated load provided they are designed, installed and operated to conform to the following requirements:

a A locking device shall be provided which will hold the car at any landing independently of the hoisting ropes while the car is being loaded or unloaded.
b The locking device shall be so designed that it cannot be unlocked unless and until the entire weight of the car and load is suspended on the ropes.
c A removable wrench or other device shall be provided to operate the locking device.
d The locking device shall be so designed that the locking bars will be automatically withdrawn should they come in contact with the landing locks when the car is operated in the up direction.
e A special capacity plate shall be provided inside the elevator car and located in a conspicuous place which shall bear the words, "CAPACITY LIFTING ONE-PIECE LOADS," in letters followed by figures giving the special capacity in pounds for lifting one-piece loads for which the machine is designed. For material and size of letters, see Rule 207.3c(1).
f The car frame, car platform, sheaves, shafts, ropes and locking device shall be designed for the specified "Capacity Lifting One-Piece Loads," provided that:
  1 In the design of the car frame, platform, sheaves, shafts, and ropes, the allowable stresses may be twenty (20) percent higher than those permitted for normal loading.
  2 The factor of safety for the locking device shall be not less than five (5).
g The car safeties shall be designed to stop and hold the specified "Capacity Lifting One-Piece Loads" with the ropes intact.
h Where there is an occupied space, or an unoccupied space not secured against unauthorized access (See Rule 109.1), under the hoistway, the following requirements shall be conformed to:
  1 The machine shall be designed to operate with the "Capacity Lifting One-Piece Loads" at slow speed.
  2 The car safety shall be designed to stop and hold the car with this load independently of the hoisting ropes.
  3 The counterweight safety, where required by Rule 109.1, shall be designed to stop and hold the entire weight of the counterweight independently of the ropes.
i* For traction machines, where necessary to secure adequate traction, additional counterweight shall be added during the period of use with one-piece loads so that the total overbalance is at least equal to forty-five (45) percent of the "Capacity Lifting One-Piece Loads."
j A special operating device of the car-switch or continuous-pressure type shall be provided in the machine room, located near the

driving machine, to operate the elevator. When this device is operative, all other operating devices shall be inoperative. (See Rule 210.1c).

k The "Capacity Lifting One-Piece Loads" of any passenger traction elevator shall not exceed one and one-third (1-1/3) times the rated load of the elevator.

Rule 207.8 Additional Requirements for Passenger Overload

Passenger elevators and freight elevators permitted by Rule 207.4 to carry employees shall be designed and installed to safely lower, stop and hold the car with an additional load up to twenty-five (25) percent in excess of the rated load.

The elevator is not required to attain rated load performance under the passenger overload conditions specified but shall conform to the requirements of the following rules:

1 Rule 205.2 except that one hundred and twenty-five (125) percent of rated load shall be used in place of rated load.

2 Rule 205.3 except that one hundred and twenty-five (125) percent of rated load shall be used in first paragraph in place of rated load.

Second paragraph of Rule 205.3, except that one hundred and twenty-five (125) percent of rated load shall be used in place of rated load and except that rated load performance including safety sliding distance is not required.

3 Rule 208.8 except that one hundred and twenty-five (125) percent of rated load shall be used in place of rated load.

4 Rule 209.2a except that one hundred and twenty-five (125) percent of rated load shall be used in place of rated load.

5 Rule 210.9e except that one hundred and twenty-five (125) percent of rated load shall be used in place of rated load.

6 Rule 210.10 except that one hundred and twenty-five (125) percent of rated load shall be used in place of rated load.

SECTION 208 — DRIVING MACHINES AND SHEAVES

Rule 208.1 Type of Driving Machines

All driving machines shall be of the traction type.

EXCEPTIONS:

(1) Winding-drum machines may be used for freight elevators subject to the following:

(a) They shall not be provided with counterweights.

(b) The rated speed of the elevator shall not exceed fifty (50) feet per minute.

(c) The travel of the elevator car shall not exceed forty (40) feet.

(2) Screw machines conforming to the requirements of Rule 208.9

The installation of belt-drive and chain-drive machines is prohibited.

Rule 208.2 Material and Grooving for Sheaves and Drums

Sheaves and drums used with suspension and compensating ropes shall:

a Be of metal finished grooves provided that grooves of sheaves not used to transmit power may be lined with rubber or other sound-isolating material.

b Have a pitch diameter of not less than:

1 Forty (40) times the diameter of the rope, where used with suspension ropes.

2 Thirty-two (32) times the diameter of the rope, where used with compensating ropes.

Rule 208.3 Factor of Safety for Driving Machines and Sheaves

The factor of safety to be used in the design of driving machines and in the design of sheaves used with suspension and compensating ropes shall be not less than:

a Eight (8) for steel, bronze, or for other metals having an elongation of at least fourteen (14) percent in a length of two (2) inches.

b Ten (10) for cast iron, or for other metals having an elongation of less than fourteen (14) percent in a length of two (2) inches.

The load to be used in determining the factor of safety shall be the resultant of the maximum tensions in the ropes leading from the sheave or drum with elevator at rest and with rated load in the car.

Rule 208.4 Bolts Transmitting Torque, and Set Screws

Bolts or other means used to transmit torque between the driving sheave and the gearing, and their supports, shall be tightly fitted without play.

Set screws or threaded portions of bolts or screws shall not be used to transmit torque.

Rule 208.5 Shaft Fillets and Keys

A fillet shall be provided at any point of change in the diameter of driving-machine shafts and sheave shafts to prevent excessive stress concentrations in the shafts.

Shafts which support drums, sheaves, gears, couplings and other members, and which transmit torque, shall be provided with tight-fitting keys.

Rule 208.6 Cast-Iron Worms and Worm Gears

Worms and worm gears made of cast iron shall not be used in elevator driving machines.

Rule 208.7 Friction Gearing and Clutches

Friction gearing or a clutch mechanism shall not be used to connect a driving-machine drum or sheave to the main driving mechanism.

Rule 208.8 Driving-Machine Brakes

The elevator driving machine shall be equipped with a friction brake applied by a spring or springs, or by gravity, and released electrically.

The brake shall be designed to have a capacity sufficient to hold the car at rest with its rated load (See also Rule 207.8 and Rule 210.8).

Rule 208.9 Screw Machines

Screw machines shall be of the uncounterweighted type and shall conform to the requirements of this section and to the following:

- a The rated speed shall not exceed fifty (50) feet per minute.
- b A car safety device conforming to Section 205 shall be provided unless other means are provided to limit the down speed of the car with rated load to not over one hundred and seventy-five (175) feet per minute if there is a failure of the driving means.
- c Where belts or chains are used to connect the motor to the driving machines the following requirements shall be conformed to:
  - 1 Belts shall be of the multiple V-belt type.
  - 2 Two or more separate chains shall be provided.
  - 3 The driving means, whether belts or chains, shall have a factor of safety of not less than ten (10).
  - 4 The machine brake shall be so located that failure of the driving belt or chain will not prevent it from performing its intended function.
- d The factor of safety of the screw as a column shall be not less than three (3) based on the total weight supported with rated load in the car.
- e Means shall be provided to maintain the screw in its vertical position in case of excessive overtravel.
- f Screws shall be of steel and nuts shall be of bronze or other material having an elongation of at least fourteen (14) percent in a length of two (2) inches.
- g A vertical casing, closed at the bottom, shall be provided to enclose and protect the screw below the nut.

Rule 208.10** *Numbering of Elevators*

When the machinery of more than one (1) elevator is in a machine room, each elevator machine shall be assigned a different number which

shall be painted on or securely attached to the driving machine. (See also Rule 210.5.)

SECTION 209 — TERMINAL STOPPING DEVICES

Rule 209.1 General Requirements

Normal and final terminal stopping-device switches shall conform to the following:

a Where located on the car or in the hoistway, they shall be of the enclosed type and securely mounted in such a manner that the movement of the switch lever or roller to open the contacts shall be as nearly as possible in a direction at right angles to a vertical plane through the centerlines of the car guide rails.

b Operating cams shall be of metal.

c The switch contacts shall be directly opened mechanically. Arrangements which depend on a spring and/or gravity to open the contacts shall not be used.

Rule 209.2 Normal Terminal Stopping Devices

209.2a* *Where Required and Function.*

Upper and lower normal terminal stopping devices shall be provided and arranged to slow down and stop the car automatically, at or near the top and bottom terminal landings, with any load up to and including rated load in the car and from any speed attained in normal operation. (See also Rule 207.8.) Such devices shall function independently of the operation of the normal stopping means and of the final terminal stopping device. The device shall be so designed and installed that it will continue to function until the final terminal stopping device operates.

NOTE: The normal terminal stopping device may be used as the normal stopping means.

209.2b *Location of Stopping Switches.*

Stopping switches for normal terminal stopping devices shall be located as follows:

1 Stopping switches for traction machines shall be located on the car, in the hoistway, or in the machine room, and shall be operated by the movement of the car.

2 Stopping switches for winding-drum machines shall be located on the car or in the hoistway, and shall be operated by the movement of the car.

209.2c *Requirements for Stopping Switches in Machine Rooms.*

Stopping switches located in a machine room shall conform to the following:

1 The stopping-switch contacts shall be mounted on and operated by a stopping device mechanically connected to and driven by the car. Stopping devices depending on friction or traction shall not be used.
2 Tapes, chains, ropes or similar devices, mechanically connecting the stopping device to the car and used as a driving means, shall be provided with a device which will cause the electric power to be removed from the elevator driving-machine motor and brake if the driving means fails.
3 Only one set of floor-stopping contacts is necessary for each terminal landing on floor controllers or other similar devices used to stop the car automatically at the landings (such as automatic operation, signal operation, etc.), provided these contacts and the means for operating them conform to subdivisions 1 and 2 of this rule. These contacts may then serve also as normal terminal stopping devices.

Rule 209.3 Final Terminal Stopping Devices

209.3a *Where Required and Function.*

Final terminal stopping devices shall be provided and arranged to cause the electric power to be removed automatically from the elevator driving-machine motor and brake after the car has passed a terminal landing. The device shall be set to function as close to the terminal landing as practicable, but so that under normal operating conditions it will not function when the car is stopped by the normal terminal stopping device. Where spring buffers are provided, the device shall function before the buffer is engaged.

The device shall be so designed and installed that it will continue to function:

1 At the top terminal landing, until the car has traveled above this landing a distance equal to the counterweight runby plus one and one-half (1½) times the buffer stroke, but in no case less than two (2) feet.
2 At the bottom terminal landing, until the car rests on its fully compressed buffer.

The operation of final terminal stopping devices shall prevent movement of the car by the normal operating devices in both directions of travel.

209.3b *Location.*

Final terminal stopping devices shall be located as follows:

1 Elevators having traction machines shall have final terminal stopping switches located in the hoistway and operated by cams attached to the car.

2 Elevators having winding-drum machines shall have final terminal stopping switches located on and operated by the driving machine and also stopping switches located in the hoistway and operated by cams attached to the car. (See also Rule 209.3d-2).

209.3c *Controller Switches Controlled by Final Terminal Stopping Device.*

The normal and final terminal stopping device shall not control the same controller switches unless two or more separate and independent switches are provided, two of which shall be closed to complete the driving-machine motor-and-brake circuit in either direction of travel. Where a two- or three-phase alternating current driving-machine motor is used, these switches shall be of the multipole type.

The control shall be so designed and installed that a single ground or short circuit may permit either, but not prevent both, the normal and final stopping device circuits from stopping the car.

209.3d *Requirements for Drum-Type Elevators.*

Final terminal stopping devices for drum machines shall conform to the following:

1 Stopping switches, located on and operated by the driving machine, shall not be driven by chains, ropes, or belts.

2 Where a two- or three-phase alternating-current driving-machine motor is used, the main-line circuit to the driving-machine motor and the circuit of the driving-machine brake coil shall be directly opened either by the contacts of the machine stop switch or by stopping switches mounted in the hoistway and operated by a cam attached to the car. The opening of these contacts shall occur before or coincident with the opening of the final-terminal stopping switch as provided in Rule 209.3a.

EXCEPTION: Driving machines equipped with a direct-current brake and having a direct-current main-line control switch in the driving-machine motor circuit controlled by a final terminal stopping switch located in the hoistway and operated by a cam attached to the car.

Rule 209.4** Emergency Terminal Speed Limiting Devices

Emergency terminal speed limiting devices shall be installed where reduced stroke buffers are used (see Rule 201.4a-2) and shall conform to the following:

a Their operation shall be entirely independent of the operation of the normal terminal stopping device and shall function to reduce the speed of the car should the normal terminal stopping device fail to slow down the car at the terminal as intended.

b They shall provide a retardation not in excess of 32.2 feet per second per second.

c They shall not apply the car safety.

d They shall be so designed and installed that a single short circuit caused by a combination of grounds or by other conditions, shall not prevent their functioning.

e** They shall be located on the car, in the hoistway, or in the machine room, and shall be operated by movement of the car.

f** Electrical switches, where located on the car or in the hoistway, shall conform to the requirements of Rule 209.1, subparagraphs a, b and c.

g** They or any components thereof located in the machine room shall conform to the following:

1 They shall be operated by a mechanism mechanically connected to and driven by the car.

2 Where their operation is dependent on car position relative to the terminal landings, friction or traction shall not be used.

3 If tape, chain, rope, etc. are used for connection to the car, the electrical power must be removed from the driving machine motor and the brake if this connection fails.

EXCEPTION: Governor ropes.

4 The same machine room mechanism and connection to the car shall not be used for operating both the normal terminal stopping device and the emergency terminal speed limiting device.

SECTION 210 — OPERATING DEVICES AND CONTROL EQUIPMENT

Rule 210.1 Operation and Operating Devices

210.1a *Types of Operating Devices.*

All operating devices shall be of the enclosed electric type. Rope or rod operating devices actuated directly by hand, or rope operating devices actuated by wheels, levers or cranks, shall not be used.

210.1b *For Car-Switch Operation Elevators.*

Handles of lever-type operating devices of car-switch operation elevators shall be so arranged that they will rerturn to the stop position and latch there automatically when the hand of the operator is removed.

210.1c *Additional Operating Devices for Elevators Equipped to Carry One-Piece Loads Greater than the Rated Load.*

Elevators equipped to carry one-piece loads greater than their rated load shall be provided with an additional operating device of the continuous-pressure type, located near the driving machine, to operate the elevator at a speed not exceeding one hundred and fifty (150) feet per minute under such conditions. The normal operating devices shall be inoperative during such operation. (See also Rule 207.7-j).

210.1d *Top-of-Car Operating Device.*

Means shall be provided to operate the elevator from on top of the car during adjustment, inspection, maintenance, and repair. (See Rules 111.10 and 111.11 for requirements for access to hoistway.)

The operating means shall conform to the following:

1 It shall be of the continuous-pressure type.

2 It shall operate the car at a speed not exceeding one hundred and fifty (150) feet per minute.

3* It shall operate the car subject to the electrical protective devices required by Rule 210.2.

4 It may be of the portable type provided the extension cord is permanently attached to the car crosshead so that the device cannot be removed from the car top.

5* It shall be so arranged and connected that when operative, the movement of the car shall be solely under the control of this device, except as provided in subdivision 8 of this rule, and any power door operating devices shall be inoperative.

6* The means for transferring the control of the elevator to the top-of-car operating device shall be on the car top and located between the car crosshead and the side of the car nearest the hoistway entrance normally used for access to the car top.

7* The device shall be used only for the purpose of adjustment, inspection, maintenance and repair of the elevator or hoistway equipment.

8* Separate additional means; of the continuous-pressure type, may also be provided to make power-door operating devices and automatic car-leveling devices operative from the top of the car for testing purposes.

210.1e *Operation in Leveling or Truck Zone.*

Operation of an elevator in a leveling or truck zone at any landing by a car-leveling or truck-zoning device, when the landing doors and/or the car doors or gates are not in the closed position, is permissible subject to the following:

1 Operating devices of manually operated car-leveling devices or

truck-zoning devices shall be of the continuous-pressure type located in the car.

2 Car platform guards, conforming to Rule 203.9, shall be provided; and where a car leveling device is used, landing sill guards, conforming to Rule 110.12g, shall also be provided.

3 The leveling zone at any landing shall not extend more than thirty (30) inches above and thirty (30) inches below any landing where an automatic leveling device is used, and not more than ten (10) inches above and below where a manually operated leveling device is used.

4 The truck zone at any landing shall not extend more than five (5) feet six (6) inches above the landing.

5 Where a truck or leveling zone for one hoistway entrance extends into the door interlocking zone for a second entrance, the truck zoning or leveling operation shall be inoperative unless the hoistway door at the second entrance is in the closed position.

Where a truck or leveling zone for one hoistway entrance extends into the leveling zone for a second entrance, the leveling operation for the second entrance shall be inoperative while the hoistway door at the first entrance is open.

EXCEPTION: The car may be operated by a car-leveling device at any landing having two (2) hoistway entrances within two (2) inches of the same level, with both car doors or gates and the corresponding hoistway doors open, provided landing sill guards, conforming to Rule 110.12g, are installed at both floors.

6 A leveling or truck-zoning device shall not move the car at a speed exceeding one hundred and fifty (150) feet per minute.

Rule 210.2 Electrical Protective Devices

Electrical protective devices shall be provided in accordance with the following:

a *Slack-Rope Switch.* Elevators having winding-drum machines shall be provided with a slack-rope device equipped with a slack-rope switch of the enclosed manually reset type which shall cause the electric power to be removed from the elevator driving machine motor and brake if the hoisting ropes become slack.

b *Motor-Generator Running Switch.* Where generator-field control is used, means shall be provided to prevent the application of power to the elevator driving machine motor and brake unless the motor generator set connections are properly switched for the running condition of the elevator. It is not required that the electrical connections between the elevator driving machine motor and the generator be opened in order to remove power from the elevator motor.

c *Compensating-Rope Sheave Switch.* Compensating-rope sheaves

shall be provided with a compensating-rope sheave switch or switches mechanically opened by the compensating-rope sheave before the sheave reaches its upper or lower limit of travel, to cause the electric power to be removed from the elevator driving machine motor and brake.

d *Motor-Field Excitation Switch.* Where generator-field control is used, a motor-field excitation switch shall be provided which shall cause the electric power to be removed from the elevator driving-machine motor and brake unless the current is flowing in the shunt field circuit of the elevator driving machine motor.

e* *Emergency Stop Switch.* An emergency stop switch shall be provided in the car, and located in or adjacent to the car operating panel. When opened, this switch shall cause the electric power to be removed from the elevator driving-machine motor and brake.

Emergency stop switches shall:

1 Be of the manually opened and closed type.

2 Have red operating handles or buttons.

3 Be conspicuously and permanently marked "STOP" and shall indicate the stop and run positions.

4 Be positively opened mechanically and their opening shall not be solely dependent on springs.

f *Broken Rope, Tape or Chain Switches Used in Connection With Machine Room Normal-Terminal Stopping Switches.* Broken-rope, tape or chain switches, conforming to Rule 209.2c-2, shall be provided in connection with normal terminal stopping devices located in machine rooms of traction elevators. Such switches shall be opened by a failure of the rope, tape or chain.

g *Stop Switch in Pit.* A stop switch conforming to the requirements of Rule 210.2-e shall be provided in the pit of every elevator. (See Rule 106.1f.)

h *Stop Switch on Top of Car.* A stop switch conforming to Rule 210.2-e shall be provided on the top of every elevator car.

i *Car-Safety Mechanism Switch.* A switch, conforming to the requirements of Rules 205.7, 206.4a, and 206.4c, shall be required where a car safety is provided.

j *Speed-Governor Overspeed Switch.* A speed-governor overspeed switch shall be provided when required by Rule 206.4a and shall conform to Rules 206.4b and 206.4c.

k *Final Terminal Stopping Devices.* Final terminal stopping devices, conforming to the requirements of Rule 209.3, shall be provided for every electric elevator.

l** *Emergency Terminal Speed Limiting Devices.* Where reduced stroke oil buffers are provided, as permitted by Rule 201.4a-2,

emergency terminal speed limiting devices conforming to Rule 209.4 shall be provided.

m *Buffer Switches for Oil Buffers used with Type C Car Safeties.* Oil-level and compression switches, conforming to the requirements of Rules 205.8b-7 and 205.8b-8, shall be provided for all oil buffers used with type C safeties (See Rule 205.5-c).

n *Hoistway-Door Interlocks or Hoistway-Door Electric Contacts.* Hoistway-door interlocks or hoistway-door electric contacts, conforming to the requirements of Section 111, shall be provided for all elevators.

o *Car-Door or Gate Electric Contacts.* Car-door or gate electric contacts, conforming to the requirements of Section 111, shall be provided for all elevators.

p *Normal Terminal Stopping Devices.* Normal terminal stopping devices, conforming to the requirements of Rule 209.2, shall be provided for every elevator.

q *Car Side-Emergency-Exit Door Contact Switches.* A car-door electric contact, conforming to the requirements ot Rule 204.2d-6, shall be provided on the car side-emergency-exit door of every elevator.

r *Motor-Generator Overspeed Protection.* Means shall be provided to cause the electric power to be removed automatically from the elevator driving-machine motor and brake should a motor generator set, driven by a direct current motor, overspeed excessively.

s *Electric Contacts for Hinged Car-Platform Sills.* Hinged car platform sills where provided, shall be equipped with electric contacts conforming to the requirements of Rule 203.16.

Rule 210.3 Voltages Permitted in Control and Operating Circuits

210.3a *In the Hoistway or on the Car.*

The maximum system or circuit potential permitted on any equipment in the hoistway or on the car shall be not more than three hundred (300) volts. Higher potentials may be used for frequencies of twenty-five (25) through sixty (60) cycles alternating current, or for direct current, provided the current in the system cannot under normal conditions, exceed eight (8) milliamperes for alternating current or thirty (30) milliamperes for direct current.

210.3b *In Other Locations.*

The nominal rated system or circuit potential for all circuits, in locations other than those specified in Rule 210.3a, shall not exceed six hundred (600) volts except for driving motors of motor generator sets.

Rule 210.4* Requirements for Electrical Equipment and Wiring

All electrical equipment and wiring shall conform to the National Electrical Code ANSI C1-1968 (NFPA 70-1968).

Rule 210.5* Power-Supply-Line Disconnecting Means

A fused disconnect switch or a circuit breaker shall be installed and connected into the power supply line to each elevator. Disconnect switches or circuit breakers shall be of the manually closed multi-pole type, and their location shall conform to the requirements of the National Electrical Code ANSI C1-1968 (NFPA 70-1968).

Disconnect means for elevators having a direct current primary power supply and rheostatic control shall have the disconnect switch arranged so that its opening will directly open the driving machine brake circuit.

Where circuit breakers are used as a disconnecting means, they shall not be of the instantaneous type and shall not be opened automatically by a fire alarm system.

Where there is more than one driving machine in a machine room, disconnect switches or circuit breakers shall be numbered to correspond to the number of the driving machine which they control (See Rule 208.10).

Rule 210.6 Phase-Reversal and Failure Protection

Elevators having polyphase alternating current power supply shall be provided with means to prevent the starting of the elevator motor if:

a The phase rotation is in the wrong direction, or

b There is a failure of any phase.

This protection shall be considered provided in the case of generator-field control having alternating current motor-generator driving motors, provided a reversal of phase will not cause the elevator driving-machine motor to operate in the wrong direction. Controllers whose switches are operated by polyphase torque motors provide inherent protection against phase reversal or failure.

Rule 210.7* Installation of Condensers or of Device to Make Electrical Protective Devices Inoperative

The installation of condensers, the operation or failure of which will cause an unsafe operation of the elevator, is prohibited. No permanent device shall be installed, except as provided in this code, which will make any required electrical protective device inoperative. (See also Rule 1002.4.)

Rule 210.8 Release and Application of Driving-Machine Brakes

Driving-machine brakes shall not be electrically released until power has been applied to the driving-machine motor.

All power feed lines to the brake shall be opened and the brake shall apply automatically when:

a The operating device of a car-switch or continuous-pressure operation elevator is in the stop position.

b A floor stop device functions.

c Any of the electrical protective devices function.

Under conditions a and b, the application of the brake may occur on or before the completion of the slow down and leveling operations.

The brake shall not be permanently connected across the armature or field of a direct current elevator driving-machine motor.

Rule 210.9 Control and Operating Circuit Requirements

In the design and installation of the control and operating circuits, the following requirements shall be met:

a If springs are used to actuate switches, contactors or relays to break the circuit to stop an elevator at the terminal landings, they shall be of the compression type.

b The completion or maintenance of an electric circuit shall not be used to interrupt the power to the elevator driving-machine motor or brake at the terminal landings, nor to stop the car when the emergency stop switch is opened or any of the electrical protective devices operate.

EXCEPTION: The requirements of this rule do not apply to dynamic braking, nor to speed control switches.

c The failure of any single magnetically operated switch, contactor or relay to release in the intended manner, or the occurrence of a single accidental ground, shall not permit the car to start or run if any hoistway door interlock is unlocked or if any hoistway door or car door or gate contact is not in the closed position.

d Where generator-field control is used, means shall be provided to prevent the generator from building up and applying sufficient current to the elevator driving-machine motor to move the car when the elevator motor control switches are in the "OFF" position. The means used shall not interfere with maintenance of an effective dynamic-braking circuit during stopping and standstill conditions.

e* The control circuits shall be so designed and installed that the car speed in the down direction with rated load in the car, under

normal operating conditions with the power supply on or off shall not exceed governor tripping speed or one hundred and twenty-five (125) percent of rated speed, whichever is the lesser. (See Rule 207.8)

Rule 210.10* Absorption of Regenerated Power

When a power source is used which, in itself, is incapable of absorbing the energy generated by an overhauling load, means for absorbing sufficient energy to prevent the elevator from attaining governor tripping speed or a speed in excess of one hundred and twenty-five (125) percent of rated speed, whichever is lesser, shall be provided on the load side of each elevator power supply line disconnecting means. (See also Rule 207.8)

Rule 210.11 Load-Weighing Devices on Passenger Elevators and on Freight Elevators Permitted to Carry Employees

Load weighing devices which will prevent operation of the elevator may be installed provided they function to prevent such operation only when the load on the elevator platform is in excess of one hundred and twenty-five (125) percent of minimum rated load as determined by Rule 207.1.

Rule 210.12 Floating (Movable) Platforms

Floating platforms which permit operation of the elevator when the car door or gate is not in the closed position are prohibited (See Rule 111.5a).

Rule 210.13* Emergency Power

An elevator may be powered by an emergency power system provided when operating on such emergency power there is conformance with the requirements of Rules 207.8 and 210.10.

EXCEPTION: Where the emergency power system is designed to operate only one elevator at a time, the energy absorption means, if required, may be located on the power side of the elevator power disconnecting means, provided all other requirements of Rule 210.10 are conformed to when operating any of the elevators the system might serve.

Other building loads such as power and light that may be supplied by the emergency power system shall not be considered as a means of absorbing the regenerated energy for the purpose of conforming to Rule 210.10 unless such loads are using their normal power from the emergency power system when it is activated.

Elevator performance on emergency power shall be checked during inspections and tests required by Rules 1000.1 and 1001.1.

SECTION 211 — EMERGENCY SIGNAL DEVICES

Rule 211.1* Car Emergency Signals for Elevators Operated Without a Designated Operator in the Car

Elevators which are operated at any time without a designated operator in the car shall be provided with the following signal devices:

a In all buildings other than private residences, such elevators shall be provided with one of the two following signal systems — item 1 or item 2.

1 A system conforming to the following:

a An electric bell operable from the car, not less than six (6) inches in diameter, located inside the building and audible outside the hoistway. One bell operable from all cars may be used for a group of elevators.

b Means of two-way conversation between each elevator and a readily accessible point outside the hoistway.

EXCEPTIONS:

(1) Elevators in buildings having a height from the lowest to the highest elevator landing of not more than sixty-five (65) feet providing the distance between any adjacent landings does not exceed fifteen (15) feet.

(2) When the means of communication with an approved service (Rule 211.1-b 2) permits two-way conversation.

c If the bell and/or the means of two-way conversation are normally connected to the building power supply, they shall automatically transfer to a source of emergency power within ten (10) seconds after the normal power supply fails. The power source shall be capable of providing for the operation of the bell for at least one (1) hour and the means of two-way conversation for at least four (4) hours.

d The emergency system shall be checked during the inspection required by Rules 1000.1 and 1001.1.

2 A telephone connected to a central telephone exchange system.

b In buildings other than apartments, hotels, or similar residential buildings and in which attendants, watchmen, or tenants are not continuously in the building and available to take action in case the emergency signal is operated, such elevators which are not provided with a telephone connected to a central exchange system shall be provided with one of the two following additional emergency signal devices — item 1 or item 2.

1 An electrical alarm bell not less than six (6) inches in diameter, operable from inside the car and enclosed in a weatherproof enclosure marked "ELEVATOR EMERGENCY — CALL POLICE," in letters not less than two (2) inches high. The alarm

bell shall be mounted on the outside of the building near the main entrance and located so that the sign can be read from the adjacent sidewalk. Only one (1) outside alarm bell is required if operable from all cars of all elevators of the type specified in the building.

An emergency power system shall be provided conforming to the requirements of subdivisions a, (1), (c), and (d) of this rule.

2 Means within the car for communicating with or signalling to an approved emergency service which operates twenty-four (24) hours each day.

SECTION 212* — HOISTING ROPES AND THEIR CONNECTIONS

Rule 212.1 Suspension Means

Elevator cars shall be suspended by steel wire ropes attached to the car frame or passing around sheaves attached to the car frame specified in Rule 203.1.

EXCEPTION: Elevators with screw machines.

Only iron (low-carbon steel) or steel wire ropes, having the commercial classification "Elevator Wire Rope," or wire rope specifically constructed for elevator use shall be used for the suspension of elevator cars and for the suspension of counterweights. The wire material for ropes shall be manufactured by the open-hearth or electric furnace process or their equivalent.

Rule 212.2 Wire Rope Data

212.2a *On Crosshead Data Plate.*

The crosshead data plate required by Rule 207.3 shall bear the following wire rope data:

1 The number of ropes.
2 The diameter in inches.
3 The manufacturer's rated breaking strength per rope in pounds.

212.2b *On Rope Data Tag.*

A metal data tag shall be securely attached to one of the wire rope fastenings. This data tag shall bear the following wire rope data:

1 The diameter in inches.
2 The manufacturer's rated breaking strength.
3 The grade of material used.
4 The month and year the ropes were installed.
5 Whether non-preformed or preformed.

6 Construction classification.
7 Name of the person or firm who installed ropes.
8 Name of the manufacturer of the rope.

A new tag shall be installed at each rope renewal.

The material and marking of the rope data tag shall conform to the requirements of Rule 207.3, except that the height of the letters and figures shall be not less than one-sixteenth (1/16) inch.

Rule 212.3 Factor of Safety

The factors of safety of the suspension wire ropes shall be not less than shown in Table 212.3. Figure 1307.1 in Section 1307 gives the minimum factors of safety for intermediate rope speeds. The factor of safety shall be based on the actual rope speed corresponding to the rated speed of the car.

The factor of safety shall be calculated by the following formula:

$$f = \frac{S \times N}{W}$$

Where: S = Manufacturer's rated breaking strength of one rope.
N = Number of runs of rope under load (See Note.).
W = Maximum static load imposed on all car ropes with the car and its rated load at any position in the hoistway.

NOTE: In the case of multiple roping, the number of runs of rope (N) under load will be: For 2:1 roping, twice the number of ropes used; for 3:1 roping, three times the number of ropes used, etc.

Rule 212.4 Minimum Number and Diameter of Supension Ropes

The minimum number of hoisting ropes used shall be three (3) for traction elevators, and two (2) for drum-type elevators.

Where a car counterweight is used, the number of counterweight ropes used shall be not less than two (2).

The term "diameter" where used in this section shall refer to the nominal diameter as given by the rope manufacturer.

The minimum diameter of hoisting and counterweight ropes shall be one-half (½) inch.

Rule 212.5 Suspension Rope Equalizers

Suspension rope equalizers where provided shall be of the individual-compression spring type.

EXCEPTION: Equalizers of other types may be used with traction elevators provided the equalizers and their fastenings are approved by the enforcing authority on the basis of adequate tensile and fatigue tests made by a qualified laboratory. Such tests shall show the ultimate strength of the equalizer and its fastenings in its several parts and assembly, which shall be not less than ten (10) percent in excess of the strength of suspension ropes as required by Rule 212.3, provided that equalizers of the single-bar type, or springs in tension, shall not be used to attach suspension ropes to cars or counterweights or to dead-end hitch-plates.

Table No. 212.3

Minimum Factors of Safety for Suspension Wire Ropes

Rope Speed in Feet Per Minute	Minimum Factor of Safety		Rope Speed in Feet Per Minute	Minimum Factor of Safety	
	Passenger	Freight		Passenger	Freight
50	7.60	6.65	700	11.00	9.80
75	7.75	6.85	750	11.15	9.90
100	7.95	7.00	800	11.25	10.00
125	8.10	7.15	850	11.35	10.10
150	8.25	7.30	900	11.45	10.15
175	8.40	7.45	950	11.50	10.20
200	8.60	7.65	1000	11.55	10.30
225	8.75	7.75	1050	11.65	10.35
250	8.90	7.90	1100	11.70	10.40
300	9.20	8.20	1150	11.75	10.45
350	9.50	8.45	1200	11.80	10.50
400	9.75	8.70	1250	11.80	10.50
450	10.00	8.90	1300	11.85	10.55
500	10.25	9.15	1350	11.85	10.55
550	10.45	9.30	1400	11.90	10.55
600	10.70	9.50	1450	11.90	10.55
650	10.85	9.65	1500	11.90	10.55

Rule 212.6 Securing of Wire Supension Ropes to Winding Drums

Car suspension ropes of winding drum machines shall have the drum ends of the ropes secured on the inside of the drum by clamps or by tapered babbitted sockets, or by other means approved by the enforcing authority.

Rule 212.7 Spare Rope-Turns on Winding Drums

Suspension wire ropes of drum-type machines shall have not less than one (1) turn of the rope on the drum when the car is resting on the fully compressed buffers.

Rule 212.8* Splicing and Replacement of Suspension Ropes

Suspension wire ropes shall not be lengthened or repaired by splicing.

If one wire rope of a set is worn or damaged and requires replacement, the entire set of ropes shall be replaced.

Rule 212.9* Hoisting Rope Fastenings

212.9a *Type of Rope Fastenings.*

The car and counterweight ends of car and counterweight wire ropes, or the stationary hitch-ends where multiple roping is used, shall be fastened in such a manner that all portions of the rope except the portion inside the rope sockets shall be readily visible.

Fastening shall be:

1 By individual tapered babbitted rope sockets (See Rule 212.9d), or
2 By other types of rope fastenings, if approved by the enforcing authority, on the basis of adequate tensile and fatigue tests made by a qualified laboratory, provided that:
  a Such fastenings conform to the requirements of Rules 212.9b and c.
  b The rope socketing shall be such as to develop at least eighty (80) percent of the ultimate breaking strength of the strongest rope to be used in such fastenings, and
  c U-bolt type rope clips (clamps) shall not be used for such fastenings.

212.9b* *Adjustable Shackle Rods.*

The car ends, or the car or counterweight dead ends where multiple roping is used, of all suspension wire ropes of traction type elevators shall be provided with shackle rods of a design which will permit individual adjustment of the rope lengths. Similar shackle rods shall be provided on the car or counterweight ends of compensating ropes.

212.9c *General Design Requirements.*

Wire rope fastenings shall conform to the following:

1 The portion of the rope fastening which holds the wire rope (rope socket) and the shackle rod may be in one piece (unit construction), or they may be separate.
2 The rope socket shall be either cast or forged steel provided that where the rope socket and the shackle rod are in one piece (unit construction), the entire fastening shall be of forged steel.
3 Where the shackle rod and rope socket are not in one piece, the shackle rod shall be of forged or rolled steel.

4** Cast or forged steel rope sockets, shackle rods and their connections shall be made of unwelded steel, having an elongation of not less than twenty (20) percent in a length of two (2) inches, conforming to ASTM Specification A235-67, Class C for forged steel and ANSI G50.1-1967 (ASTM A27-65), Grade 60/30 for cast steel and shall be stress relieved.

EXCEPTION: Steels of greater strength may be used provided they have an elongation of not less than twenty (20) percent in a length of two (2) inches.

5 Where the shackle rod is separate from the rope socket, the fastening between the two parts shall be positive and such as to prevent their separation under all conditions of operation of the elevator.

Where the connection of the two parts is threaded, the length of the thread engagement of the rod in the socket shall be not less than one and one-half (1½) times the root diameter of the thread on the rod, and a cotter pin or equivalent means shall in addition be provided to restrict the turning of the rod in the socket and prevent unscrewing of the connection in normal operation.

Eye bolts used as connections with clevis-type sockets shall be of forged steel conforming to ASTM Specification A235-67, Class C (heat treated) without welds.

6** Rope sockets shall be of such strength that the rope will break before the socket is materially deformed.

7 The shackle rod, eye bolt, or other means used to connect the rope socket to the car or counterweight, shall have a strength at least equal to the manufacturer's rated breaking strength of the rope.

8 Rope fastenings incorporating anti-friction devices which will permit free spinning of the rope shall not be used.

212.9d *Tapered Babbitted Rope-Sockets.*

Tapered babbited-type rope-sockets shall be of a design as shown in Figure 212.9d, and shall conform to the following:

1 The axial length (L) of the tapered portion of the socket shall be not less than four and three-quarters (4¾) times the diameter of the rope used.

2 The axial length (L') of the open portion of the rope socket shall be not less than four (4) times the diameter of the rope used.

3 The length of the straight bore (L'') at the small end of the socket shall be not more than one-half (½) inch nor less than one-eighth (⅛) inch, and its outer edge shall be rounded and free from cutting edges.

4 The diameter (d) of the hole at the large end of the tapered portion of the socket shall be not less than two and one-quarter (2¼) times nor more than three (3) times the diameter of the wire rope used.

5 The diameter (d') of the hole at the small end of the tapered portion of the socket shall be not more than shown in Table No. 212.9d.

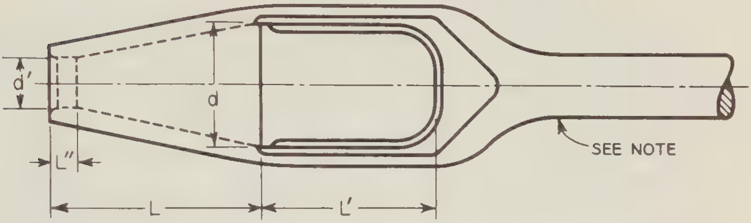


Fig. 212.9d Tapered Babbitted Rope Sockets

Table No. 212.9d*

Relation of Rope Diameter to Small Diameter of Socket

Nominal Rope Diameter In Inches	Maximum Diameter of Hole
1/2 to 3/4 inclusive	1/8″ larger than Nominal Rope Diameter
7/8 to 1-1/8 inclusive	5/32″ larger than Nominal Rope Diameter
1-1/4 to 1-1/2 inclusive	3/16″ larger than Nominal Rope Diameter

212.9e *Rope-Socket Babbitt Metal.*

Only babbitt-metal shall be used to secure ropes in tapered babbitted sockets. Babbitt metal shall contain at least nine (9) percent of antimony and shall be clean and free from dross.

212.9f *Method of Babbitting Wire Ropes in Tapered Sockets.*

Where the tapered babbitted type of socket is used, the method and procedure to be followed in making up the fastening shall conform to the following:

1* *Handling.* The rope to be socketed shall be carefully handled to prevent twisting, untwisting, or kinking.

For precautions to be taken in the handling, unreeling and uncoiling of wire rope preparatory to making up tapered babbitted sockets, reference is made to ANSI A17.2-1960 (Including supplements A17.2a-1966 and A17.2b-1967), American Standard Practice for the Inspection of Elevators, Appendix 4.

2 *Seizing of Rope Ends.* The rope ends to be socketed shall be served before cutting with seizings in accordance with the following:

a The seizing shall be done with annealed iron wire, provided that other methods of seizing may be used which give the same protection from loss of rope lay.

Where iron wire is used for seizing, the length of each seizing shall be not less than the diameter of the rope.

b For non-preformed rope, three (3) seizings shall be made at each side of the cut in the rope.

c For preformed rope, one (1) seizing shall be made at each side of the cut in the rope.

d For non-preformed rope, the first seizing shall be close to the cut end of the rope and the second seizing shall be spaced back from the first the length of the end of the rope to be turned in. The third seizing shall be at a distance from the second equal to the length of the tapered portion of the socket.

For preformed rope, the seizing shall be at a distance from the end of the rope equal to the length of the tapered portion of the socket plus the length of the portion of the rope to be turned in.

3 *Spreading of Rope Strands.* After the rope has been seized, it shall be inserted into the socket through the hole in the small end a sufficient distance for manipulation; and where non-preformed rope is used, the first two seizings shall be removed. The rope strands shall then be spread apart and where rope with fibre core is used, the fibre core shall be cut away as close as possible to the remaining seizing.

4 *Removal of Grease or Oil.* Grease and oil shall be removed by cleaning the outer surface of the exposed rope strands with a non-flammable low-toxic solvent.

5 *Turning in of Rope Strands.* The exposed rope strands shall then be bent, turned in and bunched closely together, each strand being turned back the same distance. The portion turned in shall have a length of not less than two and one-half (2½) times the diameter of the rope and such that, when the rope is pulled as far as possible into the socket, the bend of the turned-in strands shall be slightly overflush with the mouth of the tapered socket (large end) and will be visible when the socket has been babbitted. Where rope with steel core is used, the steel core shall be cut off even with tops of the looped strands.

6 *Insertion of Bent-In Rope Strands in Socket.* The rope end shall be pulled as far as possible into the socket so that the remaining seizing projects outside the hole at the small end of the socket.

7 *Position of Socket Preparatory to Pouring Babbitt.* The socket shall be held in a vertical position with the large end up, and the rope held in a position truly axial with the socket. Tape or waste may be wound around the rope at the small end of the socket to prevent the babbitt from seeping through, but shall be removed after the metal has cooled.

8 *Heating of Babbitt.* The babbitt shall be heated to a fluidity just sufficient to char a piece of soft wood such as white pine without igniting it. Care shall be taken not to overheat the babbitt sufficiently to damage the rope.

9 *Heating of Socket-Basket and Pouring of Babbitt.* The rope socket-basket shall be heated by a blowtorch flame sufficiently to prevent chilling of the babbitt and to insure that the babbitt when poured will completely fill the basket including all the spaces between the rope strands. Following this the molten babbitt shall be poured slowly and evenly into the basket until it is filled to a point level with the top of the opening in the large end.

10 *Inspection of Socket after Pouring.* When the babbitt has cooled and the tape at the small end removed, a visual inspection shall be made which shall show that:

a The babbitt is visible at the small end of the socket.

b The tops of the looped strands of the rope are just visible above the surface of the babbitt. Where rope with steel core is used, the steel core shall also be visible above the surface of the babbitt.

c The entire loop of any strand is not visible above the surface of the babbitt.

d No loss of rope lay has occurred where the wire rope enters the basket.

Babbitted sockets which do not conform to the above requirements shall be rejected and the rope resocketed.

Rule 212.10 Auxiliary Rope-Fastening Devices

Auxiliary rope-fastening devices, designed to support elevator cars or counterweights if any regular rope fastening fails, may be provided subject to the following requirements:

a They shall be approved by the enforcing authority on the basis of adequate tensile and fatigue tests made by a competent designated laboratory.

b The device and its fastenings, in its several parts and assembly,

shall have a strength at least equal to that of the manufacturer's breaking strength of the rope to which it is to be attached.

c** Steel parts used in the device shall be cast or forged with an elongation of not less than twenty (20) percent, conforming to ASTM Specifications A235-67, Class C for forgings and ANSI G50.1-1967 (ASTM 27-65), Grade 60/30 for cast steel, and shall be stress relieved.

d The device shall be so designed and installed that:

1 It will not become operative unless there is a failure of the normal rope fastening.

2 It will function in a rope movement of not over one and one-half (1½) inches.

3 It will not interfere with the vertical or rotational movements of the rope during normal service.

e Means shall be provided to cause the electric power to be removed from the driving machine motor and brake when any auxiliary fastening device operates. Such means shall:

1 Have all electrical parts enclosed.

2 Be of the manually reset type which can be reset only when the wire rope or ropes have been resocketed and the auxiliary rope-fastening device restored to its normal running position.

f The method used to attach the device to the rope shall be such as to prevent injury to, or appreciable deformation of the rope.

g The installation of the device shall not reduce the required overhead clearances.

h The car-frame supports for the fastening members of the device shall conform to the requirements of Rule 203.13.

EXCEPTION: Where existing conditions will not permit compliance with this requirement, other means of fastening may be used subject to the approval of the enforcing authority.

i Each device shall be permanently marked with the name of the manufacturer by means of metal tags or plates with the following data of the wire rope for which they are designated to be used:

1 Diameter of the rope in inches.

2 Manufacturer's rated breaking strength of the rope.

3 Construction classification of the wire rope.

The material and marking of the tags or plates shall conform to the requirements of Rule 207.3c, except that the height of the letters and figures shall be not less than one-sixteenth (1/16) inch.

PART III

HYDRAULIC ELEVATORS

SCOPE

**This part applies to hydraulic elevators of the direct plunger type.

SECTION 300 — HOISTWAYS, HOISTWAY ENCLOSURES AND RELATED CONSTRUCTION

Rule 300.1 Hoistways, Hoistway Enclosures and Related Construction

Hoistways, hoistway enclosures and related construction shall conform to the requirements of Part I except Rule 107.1 and Section 109 and of the following rules.

Rule 300.2* Machinery Rooms and Machinery Spaces

Where electrically driven pumps, electrically operated valves and electrical control equipment are located in spaces separated from the hoistway by a partition or wall having a fire resistance rating equal to that required for the hoistway enclosures, they shall not be required to be in enclosures of fire-resistive construction provided the electrical control equipment is so enclosed as to be inaccessible to unauthorized persons by either:

1 Enclosure in metal cabinets; or

2 Separation from other portions of the building by enclosures of noncombustible material conforming to Rule 100.1c provided that such enclosures may be of open work for their full height and shall be equipped with an access door conforming to the requirements of Rule 101.3d.

Rule 300.3 Bottom and Top Clearances and Runby for Cars and Counterweights

300.3a *Bottom Car Clearance.*

The bottom car clearances shall conform to the requirements of Rule 107.1a, provided that, in the determination of the required clearance, any under-car bracing which is located within six (6) inches horizontally from the edge of the car platform or three (3) inches horizontally from the centerline of the guide rails shall not be considered.

300.3b** *Minimum Bottom and Top Car Runby.*

Neither the bottom nor top car runby shall be less than:

1 Three (3) inches for rated speeds not exceeding one hundred (100) feet per minute.
2 Six (6) inches for rated speeds exceeding one hundred (100) feet per minute.

300.3c *Maximum Bottom and Top Car Runby.*

Neither the bottom nor the top car runby shall be more than twenty-four (24) inches.

300.3d *Top Car Clearance.*

The top car clearance shall be not less than the sum of the following two items:

1 The top car runby.
2 Two (2) feet, or the distance which any equipment mounted on top of the car, or on top of the car crosshead where a crosshead is provided, projects above the top of the car or above the car crosshead where a crosshead is provided, whichever is greater.

300.3e *Equipment Projecting Above the Car Top or Above the Car Crosshead.*

When the car is at the top limit of its travel as determined by the plunger, and clearance is provided as in Item 2 of Rule 300.3d, no equipment on top of the car or car crosshead shall strike any part of the overhead structure or any equipment located in the hoistway.

300.3f *Overhead Obstructions in Hoistway.*

When overhead beams or other overhead hoistway construction except sheaves are located vertically over the car, but not over the crosshead, the following requirements shall be met:

1 The clearance from the car top to such beams or construction when the car is level with the top landing shall be not less than the amount specified in Rule 300.3d.
2 Such beams or construction shall be located not less than two (2) feet horizontally from the crosshead.

300.3g *Top Clearance and Bottom Runby of Counterweights.*

Where a counterweight is provided, the top clearance and the bottom runby of the counterweight shall conform to the following:

1 Top Clearance. The top clearance shall be not less than the sum of the following:
   a The bottom car runby.
   b The stroke of the car buffers used.
   c Six (6) inches.

2 Bottom Runby. The bottom runby shall be not less than the sum of the following:
  a The distance the car can travel above its top terminal landing until the plunger strikes its mechanical stop.
  b Six (6) inches.

The minimum runby specified shall not be reduced by rope stretch. (See Rule 301.4 prohibiting counterweight buffers.)

Rule 300.4 Protection of Spaces Below Hoistway

Where the space below the hoistway is used for a passageway is occupied by persons, or if unoccupied is not secured against unauthorized access, the following requirements shall be conformed to:

a The cylinder shall be supported by a structure of sufficient strength to support the entire load that may be imposed upon it; and

b Where a counterweight is provided, the space below it shall be inaccessible to persons or the counterweight shall be provided with a safety device operated as a result of breaking or slackening of the counterweight suspension ropes.

c The car shall be provided with buffers of one of the following types:
  1 Oil buffers conforming to the requirements of Rule 301.3.
  2 Spring buffers of a design which will not be fully compressed when struck by the fully loaded car at the maximum speed attained in the down direction.

d Car buffer supports shall be provided which will withstand without permanent deformation the impact resulting from buffer engagement by the car with its rated load at the maximum speed attained in the down direction.

SECTION 301 — MECHANICAL EQUIPMENT

Rule 301.1 Guide Rails, Guide Rail Supports and Fastenings

Guide rails, guide rail supports, and their fastenings shall conform to the requirements of Section 200 with the following exceptions:

Rule 200.4a shall not apply where safeties are not used.

Rule 200.4b shall not apply where safeties are not used.

Rule 200.9a-1 shall not apply where safeties are not used.

Rule 200.11 shall not apply.

Rule 301.2 Information on Elevator Layouts

Elevator layout drawings shall, in addition to other data, indicate the following:

a The bracket spacing.
b The estimated maximum vertical forces on the counterweight guide rails on the application of the counterweight safety, where provided.
c For freight elevators with Class B or C loading (See Rule 207.2b), the horizontal forces on the car guide rail faces during loading and unloading and the estimated maximum horizontal forces in a post-wise direction on the counterweight guide rail faces on the application of the counterweight safety, where provided.
d Outside diameter and wall thickness of cylinder, plunger and piping and the working pressure.

Rule 301.3* Car Buffers or Bumpers

Car buffers or bumpers shall be provided and shall conform to the requirements of Section 201, provided that, in applying the rules of Section 201 to hydraulic elevators, the term "maximum speed in the down direction with rated load" shall be substituted for the term "rated speed", for the term "one hundred and fifteen (115) percent of rated speed" or for the term "governor tripping speed" wherever these terms appear. Car buffers or bumpers shall be so located that the car will come to rest on the bumper or fully compressed buffer before the plunger reaches its down limit of travel.

Rule 301.4 Counterweight Buffers

Where counterweights are provided, counterweight buffers shall not be provided. (See Rule 300.3g for required counterweight runby.)

Rule 301.5 Counterweights

Counterweights, where provided, shall conform to the requirements of Section 202.

EXCEPTION: Rod-type counterweights may be used provided that, in addition to the two tie rods, they also have two supporting rods having a factor of safety of not less than five (5) with the elevator at rest and the counterweight at the top of its travel.

Rule 301.6 Car Frames and Platforms

301.6a *Requirements.*

Direct-plunger elevators shall be provided with car frames and platforms conforming to the requirements of Section 203, subject to the modification hereinafter specified. (See Rule 302.2c for connection between plunger and platform or car frame.)

EXCEPTION: The car frame may be omitted provided the following requirements are conformed to:

(1) The platform frame is of such design and construction that all eccentric loads are carried through the structure and plunger attachment into the plunger. (See Rule 302.2c).

(2) The platform frame is guided on each guide rail by single guiding members attached to the frame.

(3) The platform frame is designed to withstand the forces resulting under the class of loading for which the elevator is designed without exceeding the stresses and deflections in Rule 203.10. (See Rule 1301.6).

(4) The plunger connection to the car shall be designed to transmit the full eccentric moment into the plunger with a factor of safety of not less than four (4). (See Rule 302.2c.).

(5) The plunger shall be designed to withstand the stresses due to bending during the loading and unloading of the platform based on the type of loading for which the elevator is designed. (See Rule 1302.1b.).

301.6b *Maximum Allowable Stresses and Deflections in Car Frame and Platform Members.*

The stresses and deflections in car frame and platform members and their connections, based on the static load imposed upon them, shall be not more than those permitted by Section 203, provided that the maximum stresses in the car frame uprights which are normally subject to compression shall conform to the requirements of Rule 1303.1a.

301.6c *Calculations of Stresses and Deflections in Car Frame and Platform Members.*

The calculations of the stresses and deflections in side post car frame and platform members shall be based on the formula and data in Section 1303.

For cars with corner-post or sub-post car frames, the formula and specified methods of calculations do not generally apply and shall be modified to suit the specific conditions and requirements in each case.

Rule 301.7 Car Enclosures, Car Doors and Gates and Car Illumination

Car enclosures, car doors and gates and car illumination shall conform to the requirements of Section 204.

EXCEPTION: Top emergency exits in elevator cars (See Rule 204.1e) and side emergency exits in passenger elevator cars (See Rule 204.2d) shall not be required where a manually operated valve is provided which will permit lowering the car at a reduced speed in case of failure of power or similar emergency.*

Rule 301.8 Car Safeties

Car safeties shall not be provided.

Rule 301.9 Counterweight Safeties

Counterweight safeties, where provided in accordance with the requirements of Rule 300.4-b, shall conform to the requirements of Section

205, provided that safeties shall be Type A, operated as a result of the breaking or slackening of the counterweight suspension ropes, irrespective of the rated speed of the elevator.

Rule 301.10 Capacity and Loading

The requirements of Section 207 covering capacity and loading shall apply to hydraulic elevators, provided that with Class C2 loading (See Rule 207.2b-3d) the load during the loading and unloading shall not exceed the rated load of the elevator unless all parts of the hydraulic equipment are designed for the maximum pressure developed as a result of this load.

SECTION 302 — DRIVING MACHINES

Rule 302.1 Type of Driving Machine

The machine shall be of the direct-plunger type.

Rule 302.2 Plungers

302.2a** *Material.*

Gray cast iron or other brittle material shall not be used for the plunger or connecting couplings.

302.2b *Plunger Design.*

Plungers shall be designed and constructed in accordance with the applicable formula in Rule 1302.1.

302.2c** *Plunger Connection.*

The plunger shall be attached to the car platform or car frame with fastenings of sufficient strength to support the weight of the plunger with a factor of safety of not less than four (4).

Where the plunger is subjected to eccentric loading the following requirements shall apply:

1 The plunger connection to the car shall also be designed and constructed as to transmit the full eccentric moment into the plunger with a factor of safety of not less than four (4), and
2 The plunger and the plunger connection to the car shall also be so designed and constructed that the total vertical deflection of the loading edge of the car platform due to eccentric loading of the car shall not exceed three-quarters (¾) inch.

302.2d *Plunger Joints.*

Plungers composed of more than one section shall have joints designed and constructed to:

1 Carry in tension the weight of all plunger sections below the joint, and
2 Transmit in compression the gross load on the plunger with a factor of safety of not less than five (5) based on ultimate strength.
3** For eccentric loading, the joints shall conform to the requirements of Rule 302.2b.

302.2e* *Plunger Stops.*

Plungers shall be provided with solid metal stops and/or other means to prevent the plunger from traveling beyond the limits of the cylinder. Stops shall be so designed and constructed as to stop the plunger from maximum speed in the up direction under full pressure without damage to the hydraulic system. For rated speeds exceeding one hundred (100) feet per minute where a solid metal stop is provided, means other than the normal terminal stopping device shall be provided to retard the car to one hundred (100) feet per minute with a retardation not greater than gravity, before striking the stop. (See Rule 305.2.)

302.2f *Plungers Subject to External Pressure.*

For plungers subjected to external pressure, the working pressure shall be not greater than indicated by the formula in Rule 1302.1-c.

302.2g *Plunger Heads Subject to Fluid Pressure.*

See Rule 302.3d.

302.2h** *Plunger-Follower Guide.*

A plunger-follower guide may be used provided it is arranged to limit the unsupported length of the plunger to its design as determined by Rule 1302.1 and to open the power circuit if this length is exceeded.

Rule 302.3 Cylinders

302.3a** *Material.*

Gray cast iron or other brittle material, shall not be used in the cylinder assembly.

302.3b *Cylinder Design.*

Cylinders shall be designed and constructed in accordance with the formula in Rule 1302.2.

302.3c *Clearance at Bottom of Cylinder.*

Clearance shall be provided at the bottom of the cylinder so that the bottom of the plunger will not strike the bottom head of the cylinder when the car is resting on its fully compressed buffer. (See Rule 301.3.)

302.3d *Cylinder and Plunger Heads.*

Heads of cylinders, and heads of plungers subject to fluid pressure, shall conform to the following requirements:

1** *Cylinder Heads.* Bottom heads of cylinders only shall be of dished seamless construction, concave to pressure.

2 *Design Formulas.* They shall be designed and constructed in accordance with the applicable formulas in Rule 1302.3, provided that steel heads shall in no case have a thinkess less than that required for the adjoining shell.

3 *Dished Seamless Heads, Convex to Pressure.* Dished seamless heads, convex to pressure if used on plungers, shall have a maximum allowable working pressure of not more than sixty (60) percent of that for heads of the same dimensions with pressure on the concave side.

4 *Reinforced Heads.* Reinforced heads shall be designed and constructed so that the maximum stress at rated capacity shall not exceed twelve thousand (12,000) pounds per square inch for mild steel and one-fifth (1/5) of the ultimate strength of the material for other metals.

5 *Heads Subjected to Mechanical Loads in Addition to Fluid Pressure Loads.* Pressure heads subjected to mechanical load in addition to fluid pressure loads shall be so designed and constructed that the combined stresses will not exceed the limits specified in subdivisions 2, 3 and 4 of this Rule.

302.3e *Collection of Oil Leakage.*

Means shall be provided to collect any oil leakage from the cylinder packing gland.

302.3f *Means for Relief of Air or Gas.*

Cylinders shall be provided with a means to release air or other gas.

302.3g** *Safety Bulkead.*

Cylinders shall be provided with a safety bulkhead, having an orifice of a size that would permit the car to descend at a speed not greater than fifteen (15) feet per minute, nor less than five (5) feet per minute. A space of not less than one (1) inch shall be left between the welds of the safety bulkhead and the cylinder head. Safety bulkheads shall conform to the requirements of Rule 302.3d.

EXCEPTION: Where a double cylinder is used and where both inner and outer cylinders conform to the requirements of Rule 302.3.

Rule 302.4 Welding**

Welding of parts on which safe operation depends shall be done in accordance with the appropriate standards established by the American Welding Society.

All welding of such parts shall be done by welders qualified in accordance with the requirements of the American Welding Society. At the option of the manufacturer, the welders may be qualified by one of the following:

1 By the manufacturer.
2 By a professional consulting engineer.
3 By a recognized testing laboratory.

EXCEPTION: Tack welds not later incorporated into finished welds carrying calculated loads.

SECTION 303 — VALVES, SUPPLY PIPING AND FITTINGS

Rule 303.1 Valves, Supply Piping and Fittings

303.1a* *Working Pressures.*

Valves, piping and fittings shall not be subjected to working pressures exceeding those recommended by the manufacturer for the type of service for which they are used.

The working pressure shall be legibly and permanently marked on the marking plate mounted on the power unit assembly.

303.1b* *Threads.*

Threads of valves, piping and fittings shall conform to ANSI B2.1-1968 Pipe Threads (Except Dryseal).

303.1c *Pipe Supports.*

Piping shall be so supported as to eliminate undue stresses at joints and fittings, particularly at any section of the line subject to vibration.

303.1d* *Flexible Hydraulic Connections.*

Flexible hose and fitting assemblies, and flexible couplings, may be used for hydraulic connections. Where installed between the check valve or control valve and the cylinder, they shall conform to the following requirements:

1 Flexible hose and fitting assemblies
   a Shall not be installed within the hoistway, nor project into or through any wall. Installation shall be accomplished without introducing twist in the hose, and shall conform with the minimum bending radius specified in SAE 100 R2-1967, High Pressure, Steel Wire Reinforced, Rubber Covered Hydraulic Hose.

b Shall have a bursting strength sufficient to withstand not less than ten (10) times working pressure (See Definition). They shall be tested in the factory or in the field prior to installation at a pressure of not less than five (5) times working pressure and shall be marked with date and pressure of test.

c Hose shall otherwise conform to the requirements of SAE 100 R2-1967 and shall be compatible with the fluid used therein.

d Hose fittings shall be of a non-reusable type.

e Hose and fitting assembly shall be permanently marked with the SAE hose type identification and the required replacement date which shall not be more than six (6) years beyond the installation date.

2 Flexible couplings shall be so designed and constructed that failure of the sealing element will not permit separation of the parts connected.

Rule 303.2 Relief and Check Valves

303.2a *Pump Relief Valve.*

Each pump or group of pumps shall be equipped with a relief valve conforming to the following requirements:

1 *Type and Location.* The relief valve shall be located between the pump and the check valve and shall be of such a type and so installed in the by-pass connection that the valve cannot be shut off from the hydraulic system.

2* *Setting.* The relief valve shall be pre-set to open at a pressure not greater than that necessary to maintain one hundred and twenty-five (125) percent of working pressure.

3 *Size.* The size of the relief valve and by-pass shall be sufficient to pass the maximum rated capacity of the pump without raising the pressure more than twenty (20) percent above that at which the valve opens. Two or more relief valves may be used to obtain the required capacity.

4 *Sealing.* Relief valves having exposed pressure adjustments, if used, shall have their means of adjustment sealed after being set to the correct pressure.

EXCEPTION: No relief valve is required for centrifugal pumps driven by induction motors, provided the shut-off, or maximum pressure which the pump can develop, is not greater than one hundred and thirty-five (135) percent of the working pressure at the pump.

303.2b *Check Valve.*

A check valve shall be provided and shall be so installed that it will hold the elevator car with rated load at any point when the pump

stops or the maintained pressure drops below the minimum operating pressure.

Rule 303.3** Supply Piping, Valves and Fittings

303.3a *Material.*

Supply piping materials, valves and fittings shall conform to the applicable provisions of Power Piping ANSI B31.1.0-1967 except that non-ductile material shall not be used. The material covered by B31.1.0 and other materials that may be used shall have a factor of safety of not less than five (5) based on tensile strength and an elongation of not less than ten (10) percent.

EXCEPTION: Flexible hydraulic hose and fitting assemblies, and flexible couplings.

303.3b *Wall Thickness.*

The minimum wall thickness shall conform to the following requirements:

1 *For Working Pressure Not More Than 250 Pounds per Square Inch.* For working pressures up to two hundred and fifty (250) pounds per square inch, piping equal to standard schedule forty (40) steel pipe may be used without stress analysis.

2 *For Working Pressure More than 250 Pounds per Square Inch.* For working pressures of more than two hundred and fifty (250) pounds per square inch, the wall thickness shall be not less than that determined by the formula in Rule 1302.4.

3 *Plain-End Nonferrous Pipe or Tubing.* Plain-end nonferrous pipe or tubing shall have a wall thickness not less than that determined by the formula in Rule 1302.4 where C = 0.00 and S (max) = one-fifth (1/5) of the ultimate strength of the material used.

303.3c *Threading.*

Pipe lighter than schedule forty (40) shall not be threaded.

Rule 303.4 Welding

Welding of parts on which safe operation depends shall conform to the requirements of Rule 302.4.

SECTION 304 — TANKS

Rule 304.1 General Requirements

304.1a *Capacity.*

All tanks shall be of sufficient capacity to provide for an adequate liquid reserve to prevent the entrance of air or other gas into the system.

304.1b *Minimum Level Indication.*

The permissible minimum liquid level shall be clearly indicated.

Rule 304.2 Atmosphere Storage and Discharge Tanks

304.2a *Covers and Venting.*

Tanks shall be covered and suitably vented to the atmosphere.

304.2b *Factor of Safety.*

Tanks shall be so designed and constructed that when completely filled, the factor of safety shall be not less than four (4) based on the ultimate strength of the material.

304.2c *Means for Checking Liquid Level.*

Tanks shall be provided with means for checking the liquid level. Such means shall be accessible without the removal of any cover or other part.

Rule 304.3 Pressure Tanks

304.3a* *Design, Testing and Marking.*

Tanks shall be designed, constructed, tested and marked in accordance with the ASME Code for Unfired Pressure Vessels-1968.

304.3b *Vacuum Relief Valves.*

Tanks which may be subjected to vacuum sufficient to cause collapse shall be provided with one or more vacuum relief valves with openings of sufficient size to prevent collapse of the tank.

304.3c *Gage Glasses.*

Tanks shall be provided with one or more gage glasses attached directly to the tank and equipped to shut off the liquid automatically in case of failure of the glass. The gage glass or glasses shall be so located as to indicate any level of the liquid between the permissible minimum and maximum levels, and shall be equipped with a manual cock at the bottom of the lowest glass.

304.3d *Pressure Gage.*

Tanks shall be provided with a pressure gage which will indicate the pressure correctly to not less than one and one-half (1½) times the pressure setting of the relief valve. The gage shall be connected to the tank or water column by pipe and fittings with a stop cock in such a manner that it cannot be shut off from the tank except by the stop cock. The stop cock shall have a "T" or lever handle set in line with the direction of flow through the valve when open.

304.3e *Inspector's Gage Connection.*

Tanks shall be provided with a one-quarter (¼) inch pipe size valve connection for attaching an inspector's pressure gage while the tank is in service.

304.3f *Liquid Level Detector.*

Tanks shall be provided with a means to render the elevator inoperative if for any reason the liquid level in the tank falls below the permissible minimum.

304.3g *Handholes and Manholes.*

Tanks shall be provided with means for internal inspection conforming to the following requirements:

1 *Tanks Exceeding Twelve (12) but not Exceeding Eighteen (18) Inches Inside Diameter.* Tanks exceeding twelve (12) but not exceeding eighteen (18) inches inside diameter shall have at least two (2) handhole openings or shall have two (2) threaded pipe plug inspection openings of not less than one and one-half (1½) inch pipe size.

2 *Tanks Exceeding Eighteen (18) but not Exceeding Thirty-Six (36) Inches Inside Diameter.* Tanks exceeding eighteen (18) but not exceeding thirty-six (36) inches inside diameter shall have a manhole conforming to subdivision 4 of this rule, or shall have not less than two (2) handhole openings, or shall have two (2) threaded pipe plug inspection openings of not less than two (2) inches pipe size.

3 *Tanks Exceeding Thirty-Six (36) Inches Inside Diameter.* Tanks exceeding thirty-six (36) inches inside diameter shall be provided with a manhole.

4 *Size of Manhole Openings.* Manhole openings shall be not less than eleven by fifteen (11 × 15) inches or not less than ten by sixteen (10 × 16) inches in size and if circular shall be not less than fifteen (15) inches in diameter.

5 *Size of Handhole Openings.* Handhole openings shall be not less than two by three (2 × 3) inches in size.

6 *Method of Installing.* Access and inspection openings located in a tank shell or unstayed tank head shall be installed in accordance with ASME Code for Unfired Pressure Vessels, 1968.

304.3h *Piping and Fittings for Gages.*

Piping and fittings for gage glasses, for relief valves and for pressure gages shall be of a material that will not be corroded by the liquid used in the tank.

304.3i *Location and Support of Tanks.*

Tanks shall be so located and so supported that the entire exterior may be inspected.

Rule 304.4 Welding

Welding of parts on which safe operation depends shall conform to the requirements of Rule 302.4.

SECTION 305 — TERMINAL STOPPING DEVICES

Rule 305.1 Normal Terminal Stopping Devices

305.1a *Where Required and Function.*

Upper and lower normal terminal stopping devices shall be provided and arranged to slow down and stop the car automatically, at or near the top and bottom terminal landings, with any load up to and including rated load in the car from any speed attained in normal operation (See also Rule 207.8). Such devices shall function independently of the operation of the normal stopping means and the emergency terminal speed limiting device where provided. The device shall be so designed and installed that it will continue to function until the car reaches its extreme limits of travel.

NOTE: The normal stopping device may be used as the normal stopping means.

305.1b *Location of Stopping Switches.*

Stopping switches shall be located on the car, in the hoistway, in the machine room or in overhead spaces and shall be operated by movement of the car.

305.1c *Requirements for Stopping Switches on the Car or in the Hoistway.*

Stopping switches located on the car or in the hoistway and operated by cams on the car or in the hoistway shall conform to the requirements of Rule 209.1.

305.1d *Requirements for Stopping Switches in a Machine Room or Overhead Space.*

Stopping switches located in a machine room or in an overhead space shall conform to the requirements of Rule 209.2c.

EXCEPTION: The device required by Subdivision 2 of Rule 209.2c shall cause the electric power to be removed from the main control valve or from its control switch operating magnets and, in the case of electro-hydraulic elevators, where stopping the car is affected by stopping the pump motor, from the pump motor and associated valves.

Rule 305.2** Emergency Terminal Speed Limiting Devices

305.2a** *Where Required.*

Emergency terminal speed limiting devices shall be installed where a reduced stroke buffer is used (See Rule 201.4a-2) and for the up direction where the car speed exceeds one hundred (100) feet per minute to insure that the plunger does not strike its solid limit of travel at a speed in excess of one hundred (100) feet per minute (See Rule 302.2e).

305.2b** *Requirements.*

Emergency terminal speed limiting devices shall conform to the following:

1 They shall operate independently of the normal terminal stopping device and shall function to reduce the speed of the car should this device fail to slow down the car at the terminals as intended.

2 They shall provide retardation not in excess of 32.2 feet per second per second.

3 They shall be so designed and installed that a single short circuit caused by a combination of grounds or by other conditions shall not prevent their functioning.

4 Control Means Affected.

  a Direct Plunger (Maintained-Pressure Type). The emergency terminal speed limiting and normal terminal stopping devices shall not control the same controller switches to complete the circuit to the control valve(s) unless two or more separate and independent switches are provided, two of which shall be closed in the appropriate direction of travel.

  b Electro-Hydraulic. For the up direction of travel at least two control means are required, one or both to be controlled by the emergency speed limiting device and the other or both by the normal terminal stopping device. If, in the up direction, the pump motor is the only control means, two magnetic switches, both of which shall be closed to complete the motor circuit, are required to satisfy this rule. If, however, the pump motor is one control means and there is a second control means, (e.g. a valve) only one magnetic switch for the pump motor is required. For the down direction, the emergency terminal speed limiting and normal terminal stopping devices shall each directly or through separate switches affect the control valve. Where two magnetic switches are used, the emergency terminal speed limiting and normal terminal stopping devices each may control one or both.

Rule 305.3 Final Terminal Stopping Devices.

Final terminal stopping devices are not required.

SECTION 306 — OPERATING DEVICES AND CONTROL EQUIPMENT

Rule 306.1 Types of Operating Devices

Operating devices shall be of a type conforming to the requirements of Rule 210.1a.

Rule 306.2 Top-of-Car Operating Devices

Top-of-car operating devices shall be provided and shall conform to the requirements of Rule 210.1d.

*EXCEPTIONS:**

(1) Uncounterweighted elevators having a rise of not more than fifteen (15) feet.

(2) The bottom normal terminal stopping device may be made ineffective while the elevator is under the control of the top-of-car operating device.

Rule 306.3 Anti-Creep Leveling Devices

Each elevator shall be provided with an anti-creep leveling device conforming to the requirements of Rule 210.1e subdividions 2, 3, and 6 and to the following:

a It shall maintain the car within three (3) inches of the landing from any point within the interlock zone irrespective of the position of the hoistway door.

b For electro-hydraulic elevators, it shall be required to operate the car only in the up direction.

c For maintained pressure hydraulic elevators, it shall be required to operate the car in both directions.

d* Its operation may depend on the availability of the electric power supply provided that:

1 The power supply line disconnecting means required by Rule 306.7 is kept in the closed position at all times except during maintenance, repairs and inspection, and

2 The electrical protective devices required by Rule 306.4-b shall not cause the power to be removed from the device.

Rule 306.4* Electrical Protective Devices

Electrical protective devices conforming to the requirements of Rule 210.2 shall be provided as follows:

a The following devices shall prevent operation of the elevator by the normal operating device and also the movement of the car in response to the anti-creep leveling device:

1 Stop switches in the pit.

2 Stop switches on top of car.

3 Car side emergency exit door electric contacts, where such doors are provided.

b The following devices shall prevent the operation of the elevator by the normal operating device, but the anti-creep leveling device required by Rule 306.3 shall remain operative:

1 Emergency stop switches.

2 Broken rope, tape, or chain switches on normal stopping devices when such devices are located in the machine room or overhead space.

3 Hoistway door interlocks or hoistway door contacts.

4 Car door or gate electric contacts.

5 Hinged car platform sill electric contacts.

Rule 306.5 Voltages Permitted in Control and Operating Circuits

306.5a *In the Hoistway or on the Car.*

The permissible voltages shall conform to the requirements of Rule 210.3a.

306.5b *In Other Locations.*

The nominal rated system or circuit potential for all circuits in location other than those specified in Rule 306.5a shall not exceed six hundred (600) volts except for driving motors of pumps.

Rule 306.6 Requirements for Electrical Equipment and Wiring

All electrical equipment and wiring shall conform to the requirements of the National Electrical Code ANSI C1-1968 (NFPA 70-1968).

Rule 306.7* Power Supply Line Disconnecting Means

A fused disconnect switch or a circuit breaker shall be installed and connected into the power supply line to each elevator. It shall be connected into the power supply line to control valve operating magnets and to the pump motor or motors in case of electrohydraulic elevators. Where the hydraulic pressure is supplied by a pressure tank and an electric pump, a separate disconnecting means shall be provided to disconnect the power from the pump driving motor.

Disconnect switches or circuit breakers shall be of the manually closed multiple type and their location shall conform to the requirements of the National Electrical Code ANSI C1-1968 (NFPA 70-1968). Where circuit breakers are used as the disconnecting means, they shall not be of the instantaneous type and shall not be opened automatically by a fire alarm system. Where there is equipment for more than one elevator in a machine room, disconnect switches or circuit breakers shall be numbered to correspond to the number of the elevator which they control.

Where multiple driving machines or pumping units are connected in to a single elevator, there shall be one disconnecting means to disconnect the motor or motors serving one elevator. Branch lines to each individual pump motor shall be separately protected by fuses or circuit breakers.

The disconnecting means shall be kept in the closed position at all times except during maintenance, repair and inspection (See Rule 306.3-d1).

Rule 306.8* Installation of Condensers or Devices to Make Electrical Protective Devices Inoperative

The installation of condensers or other devices to make electrical protective devices inoperative is prohibited (See Rule 210.7).

Rule 306.9 Control and Operating Circuits

The design and installation of the control and operating circuits shall conform to the following requirements:

a Springs, where used to actuate switches, contactors or relays to stop an elevator at the terminals or to actuate electrically operated valves, shall be of the compression type.

b The completion or maintenance of an electric circuit shall not be used to interrupt the power to control-valve-operating magnets nor to the pump driving motor of electro-hydraulic elevators under the following conditions:

  1 To stop the car at the terminals.

  2 To stop the car when the emergency-stop switch or any of the electrical protective devices operate.

c The failure of any single magnetically operated switch, contactor or relay to release in the intended manner or the occurrence of a single accidental ground shall not permit the car to start or run if any hoistway door interlock is unlocked or if any hoistway-door or car-door or gate contact is not in the closed position.

Rule 306.10 Loadweighing Devices on Passenger Elevators

Loadweighing devices on passenger elevators shall conform to the requirements of Rule 210.11.

Rule 306.11 Car Emergency Signal

Elevators which are operated at any time without a designated operator in the car shall be provided with an emergency signal conforming to the requirements of Rule 211.1.

SECTION 307 — COUNTERWEIGHT ROPES, ROPE CONNECTIONS AND SHEAVES

Rule 307.1 Ropes and Rope Connections

Where a counterweight is provided, the counterweight shall be connected to the car by not less than two (2) steel wire ropes.

The wire ropes and their connection shall conform to the requirements of Section 212.

EXCEPTION: The factor of safety of the wire ropes shall be not less than seven (7).

Rule 307.2 Sheaves

Sheaves for counterweight ropes shall conform to the requirements of Rules 208.2, 208.3 and 208.5.

PART IV

**POWER SIDEWALK ELEVATORS

SCOPE

**This part applies to power sidewalk elevators.

SECTION 400 — APPLICATION LIMITS

Rule 400.1 Speed Limit When the Doors in the Sidewalk or in Other Areas Exterior to the Building Are Automatically Opened and Closed**

Where the car opens and closes doors or covers in the sidewalk or in other areas exterior to the building, the rated speed shall not exceed fifty (50) feet per minute.

SECTION 401 — HOISTWAYS, HOISTWAY ENCLOSURES AND RELATED CONSTRUCTION

Rule 401.1 Applicable Requirements

Hoistways, hoistway enclosures and related construction shall conform to the requirements of the rules of Part I, except as Part I Rules are modified by the following exceptions, and to the additional rules in this section:

a *Rules 100.1a and 101.1.* The hoistway and machine room enclosures of elevators having a travel of not more than one (1) floor below the sidewalk or grade level and having the top opening in the sidewalk or other area exterior to the building may be of non-fire resistive construction.

b *Rule 100.2b.* Elevator hoistways located entirely outside the building with the top opening located in the sidewalk or other area exterior to the building, may be of non-fire resistive construction.

c *Rule 100.4.* Venting of hoistways is not required.

d *Rule 108.1e.* The clearance on the side where the overhead sheaves are located may be increased, provided that in such cases, this clearance shall not be greater than that required for the installation of the sheaves or sheave beams plus running clearance of not more than one (1) inch.

e *Rule 110.3.* Door closers are not required for bottom landing door.

f *Rule 111.1b.*

1 Combination mechanical locks and electric contacts may be used at the bottom landing.
2 Interlocks or electric contacts are not required on hinged type swinging covers and vertical lifting covers used at the top landing in sidewalks or other areas exterior to the building.
   Locks if used shall be of the spring type and shall be automatically unlocked by the bow-irons or stanchions of the car, unless the locks are of the type which permit operation of the elevators to open the cover only if the locking device is in the unlocked position.

g *Rule 111.9.* Hoistway access switches shall not be required for access to the top of the car.

Rule 401.2 Landing Openings and Covers in Sidewalks and Other Areas Exterior to the Building

401.2a *Maximum Size of Opening Permitted in Sidewalks.*

The maximum clear opening permitted in a sidewalk, when the sidewalk door or cover is open, shall not exceed five (5) feet at right angles to and seven (7) feet parallel to the building line.

401.2b *Hoistways in Front of Building Entrances Prohibited.*

Hoistways shall not be located either wholly or partially in front of any entrance to a building.

401.2c *Protection of Horizontal Openings in Sidewalks or Other Exterior Areas.*

Horizontal openings in sidewalks or other areas exterior to the building shall be protected by hinged metal doors or vertically lifting covers having a non-slip upper surface. Such doors or covers shall not be used where the hoistway is located inside the building. Doors or covers shall be of sufficient strength to safely support a static load of not less than three hundred (300) pounds per square foot, uniformly distributed.

Such doors or covers shall conform to the following requirements:

1 Hinged-Type Swinging Doors.
   a The line of the hinges shall be at right angles to the building wall.
   b The side of the door opening nearest to the building shall be four (4) inches or less from the building wall.
   c There shall be a minimum clearance of eighteen (18) inches between the face of the doors and any obstruction when the doors are in the open position.
   d The doors shall be opened by the ascending car and shall be self-closing as the car descends, and shall be kept in the closed position when the car is not at the top landing.

EXCEPTION: The doors may be held or fastened in the open position when the car is not at the top landing, provided self-closing hinged metal screen panels, which will reject a ball two (2) inches in diameter and which will support a static load of not less than three hundred (300) pounds applied on any area two (2) feet on a side and not less than one hundred and fifty (150) pounds applied at any point, are installed directly below the watertight sidewalk doors. Screen panels shall be opened and closed automatically by the ascending and descending car, and shall always be closed when the car is not at the top landing.

e Stops shall be provided to prevent the doors from opening more than ninety (90) degrees from their closed position.

2 Vertically Lifting Covers.

a The covers shall be raised and lowered vertically by the ascending and descending car and shall not be held or fastened in the open position when the car is not at the top landing.

b The edge of the cover adjacent to any building wall or other obstruction shall be not more than four (4) inches from such wall or obstruction.

c There shall be a clearance of not less than two (2) feet between the top of the cover and any obstruction vertically above it when the car is at the top of its overtravel.

d Recesses or guides, which will securely hold the cover in place on the stanchions, shall be provided on the underside of the cover.

Rule 401.3 Requirements for Electrical Wiring and Electrical Equipment

The wiring and electrical equipment shall conform to the requirements of Section 102 and to the following:

Where the top-terminal-landing opening is in the sidewalk or other area exterior to the building

a All electric wiring shall be in rigid metal conduit or electrical metallic tubing and all electrical outlets, switches, junction boxes and fittings shall be weatherproof.

b* Traveling cables, where used between the car and hoistway wiring, shall be type EO. See National Electrical Code ANSI C1-1968 (NFPA 70-1968).

c Slack-rope switches where required, lower normal and final terminal stopping devices and pit stop switches shall be located as far above the bottom of the pit as practicable.

NOTE: Under such conditions the wiring and the electrical equipment is exposed to the elements when the sidewalk doors or covers are open and may be thus exposed for a long duration of time. Even when the doors are kept closed, there may be considerable moisture in the hoistway due to changes in temperature of the air in the hoistway. Special precaution should therefore be taken when installing electrical wiring and equipment to insure its stability under the severe conditions to which it is subjected.

SECTION 402 — MACHINERY AND EQUIPMENT

Rule 402.1 Applicable Requirements

Machinery and equipment for electric elevators shall conform to the requirements of Part II and for hydraulic elevators shall conform to the requirements of Sections 301 to 306 inclusive and Rule 307.1 except as modified by the following exceptions to the rules and to the additional rules in Section 402.

a *Rule 204.1a.* Car tops are not required.

b *Rule 204.3a.* The height of the car enclosure may be reduced when the height of the bow-iron or stanchions has been reduced as permitted in Rule 402.2.

c *Rule 204.6b.* The height of the car door or gate may be reduced when the height of bow-irons or stanchions is reduced as permitted in Rule 402.2.

d *Rule 205.7.* Where the speed of an electric elevator does not exceed fifty (50) feet per minute, car safeties which operate as a result of breaking or slackening of the hoisting ropes may be used. Such safeties may be of the inertia type or approved type without governors.

e *Rule 206.1.* Governors are not required on electric elevators where the rated speed does not exceed fifty (50) feet per minute.

f *Rule 208.1.* The travel when winding-drum machines are used may exceed forty (40) feet.

g *Rule 208.2-b1.* The ratio of drum diameter to rope diameter may be less than forty (40), but shall not be less than twenty-four (24).

h *Rule 210.1d.* Top-of-car operating device shall not be required.

i *Rule 210.2-h.* Stop switches on top of the car shall not be required.

j *Rule 212.4.* For car speeds not exceeding fifty (50) feet per minute, three-eights (3/8) inch diameter steel wire ropes may be used.

k *Rule 306.2.* Top-of-car operating device shall not be required.

l *Rule 306.4-a2.* Stop switches on top of the car are not required.

Rule 402.2 Car Frames and Platforms

402.2a *Bow-Irons and Stanchions.*

Where hinged doors or vertically lifting covers are provided at the sidewalk or other area exterior to the building, bow-irons or stanchions shall be provided on the car to operate the doors or covers.

Bow-irons and stanchions shall conform to the following requirements:

1 They shall be not less than seven (7) feet high, except that this

height may be reduced by an amount necessary to permit the doors or covers to close when the car is at the landing next to the top terminal landing.

2 They shall be so designed, installed and braced as to withstand the impact when striking the doors or covers.

3 Bow-irons shall be located approximately symmetrical with respect to the center of the car platform.

4 Stanchions shall be framed together at their upper ends and provided with spring buffers at the top.

402.2b *Car Frames and Platforms of Elevators Traveling Above the Level of the Sidewalk or Other Normal-Terminal Exterior Landing.*

Sidewalk elevators arranged to travel above the level of the sidewalk or other upper-normal-terminal exterior landing shall conform to the following requirements:

1 Car frames of the underslung rope-suspended type of elevators shall be of sufficient depth to provide the minimum vertical clearance between the car rope hitches or car sheaves and any obstruction in the hoistway vertically above them, as specified in Rule 107.1g, when the car floor is level with its upper landing level.

2 The depth of the car frame and the length and spacing of guiding members shall conform to the requirements of Rule 203.4 and in addition, shall be such as to prevent tipping of the platform when it is at the highest upper landing level.

3 The car platform shall be provided with metal aprons or guards on all exposed sides conforming to the following:

a They shall be made of metal of not less than No. 16 U.S. gage.

b They shall have a straight vertical face flush with the outer edge of the platform having a depth of not less than the distance between the normal upper terminal landing level and the highest upper landing level plus three (3) inches.

c The lower portion of the guard shall be rounded or bent back at an angle of approximately seventy-five (75) degrees with the horizontal.

Rule 402.3. Terminal Stopping Devices

The terminal stopping devices shall conform to the requirements of Section 209 for electric elevators and Section 305 for hydraulic elevators and to the following additional requirements:

Elevators having their top opening located in the sidewalk or other area exterior to the building shall conform to the following:

a Stopping devices installed in the hoistway at the lower terminal shall be located as far above the bottom of the pit as practicable (See Rule 401.3-c).

b All terminal stopping devices located in the hoistway or on the car shall be weatherproof (See Rule 401.3-a).

Rule 402.4 Operating Devices and Control Equipment

The operating devices and control equipment shall conform to the requirements of Section 210 for electric elevators and of Section 306 for hydraulic elevators and to the following additional requirements:

a Where the top opening is located in the sidewalk or other area exterior to the building, all electrical equipment on the car or in the hoistway shall be weatherproof.

b The operation of elevators through openings in the sidewalk, or through openings in other exterior areas which are accessible to the public, and which are protected by hinged doors or vertically lifting covers, shall conform to the following:

1 The elevator shall be operated in both the up and down directions through the opening, only from the sidewalk or other exterior area. The operation shall be by means of:

(a) Key-operated continuous-pressure type up-and-down switches,

(b) Continuous-pressure type up-and-down operating buttons on the free end of a detachable, flexible cord not more than five (5) feet in length.

2 Key-operated switches shall be of continuous-pressure spring return type, and shall be operated by a cylinder type lock having not less than a five (5) pin or five (5) disc combination with the key removable only when the switch is in the off position.

3 Key-operated switches and plug receptacles for flexible cords shall be weatherproof and shall be installed above the sidewalk or other area on the side of the building wall, located eighteen (18) inches or less horizontally from one side of the opening.

4 Operating buttons may be provided in the elevator car and at any landing below the top landing, provided that such buttons shall operate the car only when the bow-iron or stanchions are not in contact with the doors or covers in the sidewalk or other exterior area.

5 When the bow-iron or stanchions are in contact with the doors or covers at the sidewalk or other exterior area, it shall be possible

to operate the car only by means of either the key switches or the continuous-pressure-type up-and-down buttons on the free end of the flexible cord specified in Subdivision b1 of this Rule.

6 Flexible cords and operating keys shall not be left where they are accessible to unauthorized persons for operation of the elevator.

c Operation shall be of the automatic or continuous-pressure type.

EXCEPTION: Operation through openings in sidewalks or in other exterior areas shall be as required by Subdivision . b1 of this Rule.

d Hydraulic elevators shall have electric control and operation.

PART V

PRIVATE RESIDENCE ELEVATORS AND INCLINED LIFTS

SCOPE

**This part applies to elevators and inclined lifts installed in private residences.

This part also applies to similar elevators and inclined lifts installed in multiple dwellings as a means of access to a private residence in a building, provided the elevator or lift is so installed that it is not accessible to the general public or to other occupants in the building.

SECTION 500 — PRIVATE RESIDENCE ELEVATORS

Rule 500.1 Hoistways and Hoistway Enclosures

The hoistway shall be solidly enclosed, except for exterior windows, throughout its height, without grille work or opening other than for landing or access doors. Enclosures shall be of sufficient strength to support in true alignment the hoistway doors and gates and their locking equipment, and shall conform to local laws and ordinances.

EXCEPTIONS:

(1) The enclosure may be omitted in the lowest story served provided the car platform is equipped with a device which, if the platform is obstructed in its downward travel by a force not to exceed four (4) pounds applied anywhere at its lower surface, will open an electric contact in the control circuit and thus stop the down travel of the car within the range of the free suspension of the device and not exceeding three (3) inches (See Rule 500.3b). This exception shall not apply where the lowest story is a garage.

(2) The enclosure may be omitted on the upper landing on continuous-pressure operation elevators serving only adjacent landings (one-story travel) provided the floor opening at the upper landing is protected by an enclosure and gate at least thrity-six (36) inches high with openings that will reject a ball one (1) inch in diameter.

(3) The enclosure on the upper landing may be omitted on elevators having continuous-pressure operation and serving only adjacent landings (one-story travel), where the floor opening is closed by a vertically lifting trap door which automatically closes when the top of the car descends through the opening, provided this trap door meets the following requirements:

(a) Is fitted with guides to insure its proper seating.

(b) Is designed and installed to sustain a total load of seventy-five (75) pounds per square foot or three hundred (300) pounds at any one point, and

(c) Is equipped with electric contacts that will prevent the up travel of the car when a pressure of twenty (20) pounds is placed at any point on the door.

(4) The hoistway enclosure may be omitted on elevators located in existing open stairway areas or other existing open areas provided that:

(a) The car platform is equipped with a device which will meet the requirements of Exception (1) of this Rule to stop the car if it is obstructed in its downward travel, and

(b) The entrance sides of the hoistway at the upper landings are protected as required in Exception (2) of this Rule.

Rule 500.2 Horizontal Car Clearances

500.2a *Between Car and Hoistway Enclosures or Counterweight.*

There shall be a clearance of not less than three-quarters (¾) inch between the car and the hoistway enclosure, and between the car and its counterweight.

500.2b *Between Car and Landing Threshold.*

The clearance between the car platform and the landing sill shall be not less than one-half (½) inch nor more than one and one-half (1½) inches.

Rule 500.3 Pits and Top Car Clearances

500.3a *Protection of Spaces Below Hoistways.*

Where the space below the hoistway for an elevator car or counterweight is used for a passageway or is occupied by persons, or if unoccupied is not secured against unauthorized access, the following requirements shall be conformed to:

1 The car and counterweight shall be provided with safeties conforming to Rule 501.6, and with spring buffers so designed that they will not be fully compressed when struck by the car with its rated load or by the counterweight traveling at one hundred and twenty-five (125) percent of rated speed, or at governor tripping speed where a governor-operated safety is used.

2 Car and counterweight buffer supports shall be provided, and shall be of sufficient strength to withstand without failure the impact resulting from buffer engagement at one hundred and twenty-five (125) percent of rated speed, or at governor tripping speed where a governor-operated safety is used.

EXCEPTION: Buffers may be omitted for elevators installed in single-family residences where the space below the car and counterweight consists of a cellar, provided the floor below the car and counterweight has sufficient strength to withstand without failure the impact of the car and counterweight descending at rated speed.

500.3b *Pits.*

A pit is not required at the bottom of the hoistway. The car may stop immediately on or above the bottom landing floor, or a pit may be provided to permit the car floor to stop flush with the landing floor.

A pit shall not be provided where there is no hoistway enclosure at the lowest story served.

500.3c *Top Car Clearance.*

At the top landing, there shall be a clearance above the car of not less than four (4) inches plus one (1) inch for each three and one-third (3-1/3) feet per minute of speed in excess of thirty (30) feet per minute.

Rule 500.4 Overhead Machinery Beams and Supports

500.4a *Securing of Machinery Beams and Type of Supports.*

All machinery and sheaves shall be so supported and secured as to effectually prevent any part becoming loose or displaced.

Beams directly supporting machinery shall be of steel or sound timber or reinforced concrete.

500.4b *Loads on Overhead Beams and Supports.*

Loads on overhead beams and their supports shall be computed as follows:

1 The total load on overhead beams shall be assumed as equal to the weight of all apparatus resting on the beams plus twice the maximum load suspended from the beams.

2 The load resting on the beams shall include the complete weights of the driving machine, sheaves, controller, etc.

3 The load suspended from the beams shall include the sum of the tensions in all ropes suspended from the beams.

NOTE: The object in doubling the suspended load is to allow for impact, acceleration, stresses, etc.

500.4c *Fastening of Driving Machines and Sheaves to Underside of Overhead Beams.*

The elevator driving machine or sheaves shall not be fastened to the underside of the supporting beams at the top of the hoistway.

EXCEPTION: Idlers or deflecting sheaves with their guards and frames.

Cast iron in tension shall not be used for supporting members for sheaves where they are hung beneath beams.

500.4d *Factor of Safety of Overhead Beams and Supports.*

The factor of safety for overhead beams and their supports shall be not less than:

For steel	5
For timber and reinforced concrete	6

Rule 500.5 Electrical Wiring and Pipes

500.5a *Electric Wiring.*

All wiring shall conform to the requirements of the National Electrical Code ANSI C1-1968 (NFPA 70-1968).

500.5b *Pipes in Hoistways.*

Pipes conveying steam, gas or liquids, which if discharged into the hoistway would endanger life, shall not be installed in the elevator or counterweight hoistway.

500.5c *Maximum Voltage of Motor, Control and Operating Circuits.*

Electric circuits having a nominal voltage in excess of three hundred (300) volts shall not be used for the operating, control or motor circuits. Higher potentials may be used in operating circuits for frequencies of twenty-five (25) through sixty (60) cycles alternating current, or for direct current, provided the current in the system cannot, under normal conditions, exceed eight (8) milliamperes for alternating current or thirty (30) milliamperes for direct current.

500.5d *Enclosing of Electrical Apparatus in Hoistway.*

All live parts of electrical apparatus in the hoistway shall be suitably enclosed to protect against accidental contact.

500.5e *Grounding of Electrical Equipment.*

All metal coverings or enclosures of electrical equipment shall be permanently grounded.

500.5f *Gas Lines Below Hoistway.*

There shall be no gas lines immediately below the car or counterweight runway.

Rule 500.6 Counterweight Enclosures

500.6a *Counterweight of Cars Operating Through Hatch Covers.*

If the car operates through a hatch cover, the counterweight runway shall be enclosed throughout its height.

500.6b *Counterweight Coming Down to Floors or Passing Floors or Stairs.*

Where a counterweight runway comes down to a floor or passes a floor or stairs, it shall be guarded to a height of at least seven (7) feet above the floor or the stair treads by a solid or openwork enclosure. Openwork enclosures shall reject a ball one-half (½) inch in diameter.

500.6c *Access to Enclosed Counterweights and Ropes.*

Access shall be provided for inspection, maintenance and repair of an enclosed counterweight and its ropes. Doors to the counterweight enclosures shall be self-closing and openable from the outside only with a suitable key. If the enclosure is of such a size that the door can close while the enclosure is occupied by a person, the door shall be easily openable from the inside without the use of a key or other instrument.

Rule 500.7 Protection of Hoisting Ropes Located Outside the Hoistway or Adjacent to Stairways

500.7a *Ropes Passing Through Floors or Stairs.*

Hoisting ropes passing through a floor or stairs outside the hoistway enclosure shall be enclosed to a height of not less than six (6) feet above the floor or the stair tread, with a solid or open work enclosure with openings which will reject a ball one-half (½) inch in diameter. The floor openings for the ropes shall be not greater than necessary for free passage of the ropes.

500.7b *Ropes Immediately Adjacent to Stairways.*

Hoisting ropes immediately adjacent to stairs shall be guarded with solid or openwork panels on the stair side to a height of not less than six (6) feet above the stair treads. Openwork enclosures shall reject a ball one-half (½) inch in diameter.

Rule 500.8 Hoistway Doors and Gates

500.8a *Where Required.*

Where a hoistway enclosure is required, landing openings shall be protected by swinging or sliding doors or gates. Landing openings in solid hoistway enclosures shall be protected by solid swinging or sliding doors.

500.8b *Clearance Between Hoistway Doors or Gates and Landing Sills and Car Doors or Gates.*

The clearance between the hoistway doors or gates and the hoistway edge of the landing sill shall not exceed two (2) inches and the distance between the hoistway face of the landing door or gate and the car door or gate shall not exceed four (4) inches.

500.8c *Projections of Hoistway Doors or Gates into Hoistway.*

The hoistway face of the landing doors or gates shall not project into the hoistway beyond the landing sill. No hardware, except that required

for door locking or contacts, signals or door-operating devices shall project into the hoistway beyond the line of the landing sill.

500.8d *Locking Devices for Hoistway Doors or Gates.*

Hoistway doors or gates shall be provided with locking devices and electric contacts conforming to the following:

The locking device shall be either of a type which will prevent starting the car unless the door or gate is locked in the closed position, or it may permit the car to start if the door or gate is in the closed position but not locked, provided the device will stop the car if the door or gate fails to lock before the car has moved more than twelve (12) inches away from the landing. The device shall also prevent opening any hoistway door or gate unless the car is within twelve (12) inches of that landing.

500.8e** *Access to Hoistways for Emergency Purpose.*

Hoistway door unlocking devices may be provided for all hoistway doors and, where provided, shall conform to the following:

1 The elevator shall have hoistway doors which are unlocked when closed with the car at a landing, or locked and openable from the landing side by means effective only when the car is in the landing zone.
2 The device shall unlock and permit opening of the hoistway door from the landing irrespective of the position of the car.
3 The device shall be designed to prevent unlocking the door with common tools.
4 The operating means for unlocking the door shall be kept on the premises by the person responsible for maintenance and operation of the elevator. It shall be readily available only to qualified persons for emergency use.

500.8f *Opening of Hoistway Doors and Gates.*

Hoistway doors or gates shall be so arranged that it will not be necessary to reach back of any panel, jamb or sash to operate them.

500.8g *Hangers and Stops for Sliding Hoistway Doors.*

Means shall be provided to prevent hangers for sliding hoistway doors from jumping the track. Stops shall be provided to prevent the hanger carriage from leaving either end of the track, or suitable stops shall be provided on the door.

SECTION 501 — MACHINERY AND EQUIPMENT

Rule 501.1 Guide Rails and Guide Rail Fastenings

501.1a *Material.*

Car and counterweight guide rails shall be of steel.

501.1b *Fastenings, Deflections and Joints.*

Guide rails shall be securely fastened, shall not deflect more than one quarter (¼) inch under normal operation and shall have their joints well-fitted and strongly secured. Guide rails and their joints and fastenings shall withstand without failure the application of the car safety when stopping the car with its rated load.

501.1c *Extension of Guide Rails at Top and Bottom of Hoistway.*

Guide rails shall extend from the bottom of the hoistway to a height above the top landing sufficient to prevent the guide shoes from running off the guides when the car or counterweight is at its extreme upper position.

Rule 501.2 Counterweight Guiding and Construction

501.2a *Guiding.*

Counterweights, where used, shall run in guides.

501.2b *Car Counterweights.*

Where a car counterweight is used, it shall not be of sufficient weight to cause undue slackening of any car hoisting rope during acceleration or retardation of the car.

501.2c *Fastening of Counterweight Sections.*

The counterweight sections, whether carried in a frame or not, shall be fastened together.

Rule 501.3 Car Construction

501.3a *Car Frames and Platforms.*

Elevator cars shall have metal or combination metal and wood car frames and platforms. Car frames and platforms shall have a factor of safety of not less than five (5) based on the rated load.

501.3b *Use of Cast Iron.*

Cast iron shall not be used in the construction of any member of the car frame or platform other than for guide shoes and guide-shoe brackets.

501.3c *Use of Glass.*

Glass shall not be used in elevator cars except for the car light and appliances necessary for the operation of the car.

501.3d *Number of Compartments.*

The car shall have not more than one (1) compartment.

Rule 501.4 Car Enclosures

501.4a *Enclosures Required.*

Except at the entrance, cars shall be enclosed at sides and top. The enclosure at the sides shall be solid or of openwork which will reject a ball one-half (½) inch in diameter.

501.4b *Securing Enclosures.*

The car enclosure shall be secured to the platform in such a manner that it cannot work loose or become displaced in regular service.

501.4c *Light in Car.*

Each car shall be provided with an electric light to illuminate the car. The control switch for the light shall be located near the car entrance.

Rule 501.5 Car Doors or Gates

501.5a *Doors or Gates Required*

A car door or gate which, when closed, will guard the opening to a height of at least five (5) feet six (6) inches, shall be provided at each entrance to the car. Car doors may be of solid or openwork construction which will reject a ball three (3) inches in diameter.

501.5b *Door or Gate Electric Contacts.*

Car doors or gates shall be provided with an electric contact which will prevent operation of the elevator by the operating device unless the car door or gate is within two (2) inches of full closure.

501.5c *Operation of Doors or Gates.*

Car doors or car gates may be manually or power operated, or may be closed by a weight or spring. Collapsible gates shall not be power-opened to a distance exceeding one-third (1/3) the clear door or gate opening and in no case exceeding ten (10) inches.

501.5d *Openings in Car Gates.*

Collapsible car gates shall be of a design that, when fully closed (extended position), will reject a ball three (3) inches in diameter.

501.5e *Car-Door or Gate Mechanical Locks.*

Where the hoistway enclosure is omitted at the bottom landing, the car door or gate shall be provided with a mechanical look which will lock it in the closed position when the car is more than six (6) inches away from any landing.

501.5f *Design of Car-Door or Gate Electric Contacts.*

Car-door or car-gate electric contacts shall be positively opened by a

lever or other device attached to and operated by the door or gate and shall be maintained in the open position by the action of gravity or a restrained compression spring or both, or by means of a positive linkage.

Rule 501.6 Car Safeties and Governors

501.6a *Where Required*

Elevator cars suspended by wire ropes or chains shall be provided with a car safety capable of stopping and sustaining the car with rated load.

501.6b *Operation of Car Safeties.*

The car safety shall be of the inertia or other approved type operated as a result of the breakage of the hoisting ropes or by a speed governor. If of the speed-governor type, the governor shall operate to set the safety at a maximum speed of one hundred and seventy-five (175) feet per minute and on breakage of the hoisting ropes, the safety shall operate without appreciable delay and independently of the governor speed action.

501.6c *Location of Speed Governor.*

Where a speed governor is used, it shall be located where it cannot be struck by the car or counterweight in case of overtravel and where there is sufficient space for full movement of the governor parts.

501.6d *Opening of Brake and Motor Control Circuits on Safety Application.*

Where a speed governor is used, the motor-control circuit and the brake-control circuit shall be opened before or at the time the safety applies.

501.6e *Governor Ropes.*

The governor ropes shall be of iron, steel, monel metal or phosphor bronze not less than one-quarter (¼) inch in diameter. Tiller-rope construction shall not be used.

501.6f *Slack-Rope and Slack-Chain Devices for Winding-Drum and Roller-Chain-Type Driving Machines.*

Elevators of the winding-drum type with rope suspension shall be provided with a slack-rope device of the manually reset type which will remove the power from the motor and brake if the car is obstructed in its descent and the hoisting ropes slacken.

Elevators with roller-chain suspension shall be provided with a slack-chain device which will remove the power from the motor and brake if the car is obstructed in its descent and the hoisting chains slacken. This device need not be of the manually reset type if the chain sprockets are guarded to prevent the chain from jumping off the sprockets.

501.6g *Application of Car Safety.*

A car safety device which depends upon the completion or maintenance of an electric circuit for the application of the safety shall not be used. Car safeties shall be applied mechanically.

501.6h *Use of Cast Iron in Car Safeties.*

Cast iron shall not be used in the construction of any part of a car safety the breakage of which would result in failure of the safety to function to stop and sustain the car.

501.6i *Car Safety Tests.*

A test of the car safety shall be made with rated load in the car before the elevator is put into service. Governor operation of instantaneous-type safeties shall be tested at rated speed by tripping the governor by hand. Safeties operated as the result of the breaking of the hoisting ropes shall be tested by obtaining the necessary slack rope to cause them to function.

Rule 501.7 Capacity Plates in Cars

A metal plate provided by the manufacturer shall be fastened in a conspicuous place in the car stating the rated load in pounds, with letters and figures not less than one-quarter (¼) inch high.

Rule 501.8* Limitation of Load, Speed, Rise and Platform Area

The rated load shall not exceed seven hundred (700) pounds. The inside net platform area shall not exceed twelve (12) square feet. The minimum rated load shall be not less than that based on forty (40) pounds per square foot of inside net platform area or three hundred and fifty (350) pounds, whichever is greater. The rated speed shall not exceed forty (40) feet per minute. The rise shall not exceed fifty (50) feet.

NOTE: Elevators which exceed any of these limits are not included in the Scope of Part V. For applicable requirements, refer to Parts I, II and III of this Code.

Rule 501.9 Driving Machines and Sheaves

501.9a *Materials for Drums and Sheaves and Minimum Diameter.*

Winding drums, traction sheaves and overhead and deflecting sheaves shall be of cast iron or steel, of a diameter of not less than thirty (30) times the diameter of the wire hoisting ropes. The rope grooves shall be machined.

EXCEPTION: Where 8 × 19 steel ropes are used, the diameter of drums and sheaves may be reduced to twenty one (21) times the diameter of the rope.

501.9b *Factor of Safety.*

The factor of safety, based on the static load (the rated load plus the weight of the car, ropes, counterweights, etc.) to be used in the design of driving machines and sheaves shall be not less than:

Eight (8) for wrought iron and steel.

Ten (10) for cast iron, cast steel and other material.

501.9c *Set-Screw Fastenings.*

Set-screw fastenings shall not be used in lieu of keys or pins if the connection is subject to torque or tension.

501.9d *Friction-Gearing or Clutch Mechanism.*

Friction-gearing or clutch mechanisms shall not be used for connecting the drum or sheaves to the main driving gear.

501.9e *Use of Cast Iron in Gears.*

Worm gearing having cast-iron teeth shall not be used.

501.9f *Driving Machine Brakes.*

Driving machines shall be equipped with electrically released spring-applied brakes.

501.9g *Operation of Brake.*

A single ground or short circuit, a counter-voltage or a motor field discharge shall not prevent the brake magnet from allowing the brake to set when the operating device is placed in the stop position.

501.9h *Driving-Machine Cranks for Emergency Operation.*

Electric elevator driving machines shall be arranged for manual operation by means of a crank in case of power failure. A suitable crank shall be provided and kept near the machine.

501.9i* *Driving-Machine Roller-Chain Sprockets.*

Driving-machine chain sprockets shall be steel and shall conform in all particulars of design and dimensions to ANSI B29.1-1963, Transmission Roller Chains and Sprocket Teeth.

501.9j* *Screw Machines.*

Screw machines where used shall conform to the requirements of Rule 208.9.

501.9k** *Hydraulic Driving Machines.*

Hydraulic driving machines shall conform to the requirements of Section 302.

EXCEPTION: When roped-hydraulic machines are used, the design need not conform to the requirements of Rule 302.1, 302.2 and 302.3c.

Rule 501.10 Terminal Stopping Devices

501.10a *Stopping Devices Required.*

Upper and lower normal terminal stopping devices operated by the car shall be provided, and shall be set to stop the car at, or near, the upper and lower terminal landings.

Upper and lower final terminal stopping devices operated by the car shall also be provided and shall be set to stop it before it strikes the overhead or pit bottom.

EXCEPTION: Where no hoistway enclosure is provided at the lower landing, the final terminal stopping device operated by the car may be omitted at this landing.

If the driving machine is of the winding-drum or sprocket-chain-suspension type, a final terminal stopping device shall also be provided and operated by the driving machine.

501.10b *Operation of Stopping Devices.*

The final terminal stopping device shall act to prevent movement of the car in both directions of travel. The normal and final terminal stopping devices shall not control the same switches on the controller unless two or more separate and independent switches are provided, two of which shall be closed to complete the motor and brake circuit in each direction of travel.

Rule 501.11 Operation

501.11a *Types of Operation.*

The following types of operation are permitted:

1 Continuous-pressure operation.
2 Momentary-pressure operation with up-down buttons or switches in the car and up-down buttons or switches, or call buttons, at each landing. It is not required that the operation be selective.
3 Single-automatic operation.

501.11b *Emergency Stop Switches in Cars.*

An emergency stop switch shall be provided on or adjacent to the car operating panel. Stop switches shall be of the manually opened and manually closed type with red handles or buttons and conspicuously marked "STOP." Where springs are used, their failure shall not prevent opening of the switch.

501.11c* *Control and Operating Circuit Requirements.*

The design and installation of the control and operating circuits shall conform to the following:

1 Control systems which depend on the completion or maintenance of an electric circuit shall not be used for:

a Interruption of the power and application of the machine brake at the terminals.
b Stopping of the car when the emergency stop switch in the car is opened or any of the electrical protective devices operate.
c Stopping the machine when the safety applies.

2 If springs are used to actuate switches, contactors or relays to break the circuit to stop an elevator at the terminal, they shall be of the compression type.
3 The failure of any single magnetically operated switch, relay or contactor to release, in the intended manner, or the occurrence of a single accidental ground, shall not permit the car to start if any hoistway door or car door or gate is not in the closed position, and shall not permit the car to move more than twelve (12) inches away from a floor with the hoistway door unlocked (See Rule 500.8d).

501.11d *Hand-Rope Operation.*

Hand-rope operation shall not be used.

Rule 501.12 Suspension Means

501.12a* *Types Permitted.*

Suspension means shall be not less than two (2) wire ropes or shall be not less than two (2) steel roller-type chains conforming to ANSI B29.1-1963, Transmission Roller Chains and Sprocket Teeth.

501.12b *Types Prohibited.*

Steel tapes shall not be used as suspension means.

501.12c *Minimum Diameter of Suspension Ropes.*

On elevators having a rated load of four hundred and fifty (450) pounds or less and operating at a rated speed of thirty (30) feet per minute or less, ropes shall be not less than one-quarter (¼) inch in diameter. Where the rated load exceeds four hundred and fifty (450) pounds or the rated speed exceeds thirty (30) feet per minute, ropes shall be not less than three-eighths (⅜) inch in diameter.

501.12d *Factor of Safety of Suspension Means.*

The factor of safety of the suspension means shall be not less than seven (7).

When the car and counterweight are suspended by steel ropes and the driving means between the machine and the counterweight is an endless steel roller-type chain drive, the factor of safety of such chain with rated load on the car shall be not less than eight (8).

501.12e *Arc of Contact of Suspension Means on Sheaves and Sprockets.*

The arc of contact of a wire rope on a traction sheave shall be sufficient to produce adequate traction under all load conditions. The arc of contact of a chain with a driving sprocket shall be not less than one hundred and forty (140) degrees.

501.12f *Idle Turns of Ropes on Winding Drums.*

All wire ropes anchored to a winding drum shall have not less than one (1) full turn of rope on the drum when the car or counterweight has reached its limit of possible overtavel.

501.12g* *Lengthening, Splicing, Repairing or Replacing Suspension Means.*

No car or counterweight wire rope shall be lengthened oı repaired by splicing. Broken or worn suspension chains shall not be repaired.

If one wire rope or a chain of a set is worn or damaged and requires replacement, the entire set of ropes or chains shall be replaced.

501.12h *Securing Ends of Suspension Ropes in Winding Drums.*

The winding-drum ends of car and counterweight wire ropes shall be secured by clamps on the inside of the drum or by one of the methods specified in Rule 501.12i for fastening wire ropes to car or counterweight.

501.12i* *Fastening of Rope Suspension-Means to Cars and Counterweights.*

The car or counterweight ends of wire ropes shall be fastened by return loop, by properly made individual tapered babbitted sockets or by properly attached fittings as recommended by wire rope manufacturers. Clamps of the U-bolt type shall not be used.

Tapered babbitted rope sockets and the method of babbitting shall conform to the requirements of Rules 212.9d and 212.9f. The diameter of the hole in the small end of the socket shall not exceed the nominal diameter of the rope by more than three thirty-seconds (3/32) of an inch.

Rule 501.13 Emergency Signal

An emergency signal, audible outside the hoistway and operated from within the car shall be provided and a telephone shall be installed in the car and connected to a central exchange.

SECTION 502 — PRIVATE RESIDENCE INCLINED LIFTS

Rule 502.1 Capacity and Rated Load

The capacity shall not exceed two (2) persons. The rated load shall be

not less than two hundred and fifty (250) pounds for the single-seat lift and shall be not less than four hundred (400) pounds for a lift having two (2) seats.

Rule 502.2 Rated Speed

The rated speed measured along the incline shall not exceed fifty (50) feet per minute.

Rule 502.3 Carriage

The carriage (or chair) shall have a foot platform with a seat or seats, and shall have handgrips so arranged as to provide safe support for passengers.

Rule 502.4 Free Passageway on Stairway

The equipment shall be so constructed as to permit a free passageway width of not less than twenty (20) inches throughout the length of the stairway. If the seat and platform fold automatically when not in use, this clearance may be measured from the folded position.

Rule 502.5 Carriage Truck and Guides

The carriage shall be securely anchored to a truck which supports it. The truck shall be retained in a track or guide-rail assembly.

Rule 502.6 Anchoring of Guides

The supporting guide rails shall be securely anchored to the stairs or side wall.

Rule 502.7 Factors of Safety

The factor of safety used in the design of the carriage, truck, guide rails, sprockets and sheaves shall be not less than five (5), based on the rated load.

Rule 502.8 Location of Power Unit and Alignment and Guarding of Sheaves

The power unit may be mounted on the carriage or placed at a remote location. If remotely located, all intervening sheaves or sprockets shall be placed so that the rope or chain travels in proper alignment. All sheaves shall be enclosed or guarded.

Rule 502.9** Carriage Safety Device and Slack-Rope or Chain Device

The carriage shall be provided with a safety of the instantaneous type operating on failure or slackening of the hoisting rope or chain. A slack-rope or chain switch shall be provided which will remove the power from the motor and brake if the hoisting rope or chain fails or slackens.

Rule 502.10 Operating Device

The lift shall be operated by continuous-pressure-up-and-down switches on the carriage and/or at the terminal landings.

Rule 502.11 Material and Diameter of Winding Drums and Sheaves and Rope Grooves

Winding drums and sheaves shall be of cast iron or steel. The diameter of drums or sheaves shall be not less than thirty (30) times the diameter of the wire hoisting ropes and shall have machined rope-grooves.

EXCEPTION: Where 8 × 19 elevator wire rope or 7 × 19 aircraft cable is used as a connecting means between the carriage and the driving machine, the diameter of drums and sheaves may be reduced to twenty-one (21) times the diameter of the rope or cable.

Rule 502.12 Connecting Means

Where the carriage is connected to the driving machine by a rope, cable or chain, a single connecting means may be used. The connecting means shall be any one of the following:

a Steel or iron elevator wire rope;
b Steel aircraft cable;
c Roller chain.

The diameter of the ropes or cables shall be not less than the following:

a One-quarter (¼) inch for elevator wire rope;
b One-eighth (⅛) inch for aircraft cable.

The connecting means shall have a factor of safety of not less than seven (7) based on the tension in the rope, cable or chain when raising the carriage and its rated load. In no case shall the rated breaking strength of the rope, cable or chain be less than one thousand and eight hundred (1800) pounds.

Rule 502.13 Terminal Stopping Devices

Upper and lower normal terminal stopping switches, operated by the carriage shall be provided and set to stop the carriage if it should overtravel the normal top and bottom terminal. A final terminal stopping switch, operated by the carriage, shall be provided and set to stop the carriage if it should overtravel the normal top terminal.

The final terminal stopping device shall act to prevent movement of the carriage in both directions of travel. The normal and final terminal stopping devices shall not control the same switches on the controller unless two or more separate and independent switches are provided, two of which shall be closed to complete the motor and brake circuits in each direction of travel.

Rule 502.14 Machine Brake and Driving Machine**

A machine brake of the electrically released spring applied type shall be provided.

The driving machine shall be directly connected to the motor, or may be connected to the motor by multiple V-belts, or by a multiple-link belt-type chain. Where a chain-drive or belt-drive machine is used, a broken-chain or broken-belt device shall be provided to remove the power from the motor and brake if the chain or belt fails or slackens.

Rule 502.15 Electric Wiring

All electric wiring shall comply with the National Electrical Code ANSI C1-1968 (NFPA 70-1968).

PART VI

HAND ELEVATORS

SCOPE

**This part applies to hand operated elevators.

SECTION 600 — HOISTWAYS, HOISTWAY ENCLOSURES AND RELATED CONSTRUCTION

Rule 600.1 Applicable Requirements

Hoistways, hoistway enclosures and related construction shall conform to the requirements of Part I except that the following rules and sections do not apply:

Rule	100.3	Floor Over Hoistways.
Rule	100.6	Projections, Recesses and Setbacks in Hoistway Enclosures.
Rule	101.1a	Enclosures Required for Elevators Having Fire-Resistive Hoistway Enclosures.
	101.1b	Enclosures Required for Elevators Having Non-Fire-Resistive Hoistway Enclosures.
Rule	101.2	Equipment in Machine Rooms.
Rule	101.4	Head Room in Machine Rooms and Overhead Machinery Spaces.
Rule	101.5b	Ventilation for Machinery and Control Equipment.
Section	*102*	*Installation of Raceways and Wiring in Hoistway and Machine Rooms.*
Section	*103*	*Location and Guarding of Counterweights.*
Section	*104*	*Guarding of Exposed Equipment.*
Section	*106*	*Pits.*
Section	*107*	*Bottom and Top Clearances for Elevator Cars and Counterweights.*
Section	*108*	*Horizontal Car and Counterweight Clearances.*
Rule	110.2a	For Passenger Elevators and Freight Elevators Authorized to Carry Employees.

110.2b	For Freight Elevators.
Rule 110.3	Closing of Hoistway Doors.
Rule 110.7	Hoistway Door Vision Panels.
Rule 110.9	Hoistway-Door Locking Devices and Hoistway-Door Power Operators.
Section 111	*Hoistway-Door Locking Devices, Car Door or Gate Electric Contacts, Hoistway Access Switches, and Elevator Parking Devices.*
Section 112	*Power-Operation, Power Opening, and Power Closing of Hoistway Doors and Car Doors or Gates.*

Rule 600.2 Enclosures for Machines and Control Equipment

Elevator machines and their control equipment may be located inside the hoistway enclosure at the top or bottom without intervening enclosures or platforms.

Machines of sidewalk elevators having a travel of not more than one (1) floor, and having an opening into the building at the bottom terminal landing only, are not required to be enclosed.

Rule 600.3 Pits

Pits are not required.

Rule 600.4 Top Clearances

600.4a *Top Car Clearance.*

The top car clearance shall be not less than the sum of the following:

1 The bottom counterweight runby, if any.
2 The stroke of the counterweight buffer where a spring-type buffer is used. (Buffer not required for sidewalk elevators.)
3 Twelve (12) inches.

600.4b *Top Counterweight Clearance.*

The top counterweight clearance shall be not less than the sum of the following:

1 The bottom car runby, if any.
2 The stroke of the car buffer where a spring-type buffer is used. (Buffer not required for sidewalk elevators.)
3 Six (6) inches.

Rule 600.5 Hoistway Entrances

600.5a *Types of Entrances.*

Entrances shall be of the following types:

1 Self-closing or manually operated horizontally sliding or swinging, single section.
2 Self-closing or manually operated horizontally swinging, two section (Dutch Type) with one section above the other and the lower section extending not less than forty-two (42) inches above the floor and arranged to be opened only when the car is in the landing zone and after the upper section has been opened and to be closed by the closing of the upper section.
3 Manually operated vertically sliding counterweighted, single- or multi-section.
4 Manually operated vertically sliding bi-parting counterbalanced.
5 For sidewalk elevator doors in sidewalks or other areas exterior to the buiding see Rule 401.2c.

600.5b *Closing of Hoistway Doors.*

All doors shall be kept closed except the door at the floor where the car is being operated or is being loaded or unloaded.

Manually operated doors shall be equipped with approved devices to close them automatically when released by the action of heat. Self-closing doors may be equipped with hold-open devices provided that such devices shall be equipped with fusible links which will release the door in case of excessive heat.

EXCEPTION: Bottom landing doors of sidewalk elevators.

600.5c *Signs on Hoistway Doors.*

Every hoistway door shall have conspicuously displayed on the landing side in letters not less than two (2) inches high the words: "DANGER-ELEVATOR-KEEP CLOSED"

Rule 600.6 Hoistway Gates for Landing Openings

Hoistway-landing openings equipped with horizontally sliding or swinging doors shall also be provided with vertically sliding semi-automatic gates, not less than forty-two (42) inches high, of a design that will reject a ball two (2) inches in diameter. Gates shall be so constructed and guided as to withstand a lateral force of one hundred (100) pounds concentrated at the center of the gate without being deflected beyond the line of the landing sill, and a force of two hundred and fifty (250) pounds without forcing the gate from its guides or without causing it to break or be permanently deformed.

Rule 600.7 Hoistway-Door and Hoistway-Gate Locking Devices

Hoistway doors, and hoistway gates where required shall be provided with locking devices as follows:

a *Door Latches.* Hoistway doors shall be provided with spring-type latches to hold them in the closed position. Such latches may be released from both the hoistway and landing side, irrespective of the position of the car.

b *Gate Locks.* Hoistway gates required with horizontally sliding or swinging type of hoistway doors (See Rule 600.6) shall be provided with hoistway-gate separate mechanical locks.

1 *Type Required.* Hoistway-gate separate mechanical locks shall be of a type actuated only when the car is within the landing zone by a cam attached to the car.

2 *General Design Requirements.* The lock shall hold the gate in the closed position by means of gravity or by a restrained compression spring, or by both.

3 *Closed Position.* Hoistway gates provided with hoistway-gate separate mechanical locks shall be considered to be in the closed position when the gate is within three-eighths (⅜) inches of contact with the landing sill.

SECTION 601 — CAR CONSTRUCTION

Rule 601.1 Car Enclosures

Cars shall be enclosed on the sides not used for entrance. The deflection of the enclosure shall be not more than one-quarter (¼) inch when subjected to a force of seventy-five (75) pounds applied perpendicularly to the car enclosure at any point. The enclosure shall be secured to the car platform or frame in such a manner that it cannot work loose or become displaced in ordinary service.

EXCEPTION: Sidewalk elevators.

Rule 601.2 Car Frames and Platforms

Car frames and platforms shall be of metal or sound seasoned wood designed with a factor of safety of not less than four (4) for metal and six (6) for wood, based on the rated load uniformly distributed. Connection between frame members of the car frame and the platform shall be riveted, bolted, or welded.

Sidewalk elevator platforms shall be provided with steel bow-irons or stanchions to open sidewalk doors or covers (See Rule 402.2a).

Rule 601.3 Use of Glass in Cars

Glass shall not be used in elevator cars except as permitted in Rule 204.1h.

Rule 601.4 Car Compartments

Elevator cars upon which an operator is permitted to ride shall have not more than one compartment.

Rule 601.5 Cars Counterbalancing One Another

Elevator cars upon which persons are permitted to ride shall not be arranged to counterbalance each other.

SECTION 602 — CAR SAFETY DEVICES

Rule 602.1 Car Safeties

Elevators having a travel of more than fifteen (15) feet shall be provided with a car safety, attached to the underside of the car frame, capable of stopping and sustaining the car and rated load.

The car safety device is not required to be operated by a speed governor, and may be of the instantaneous type operated as a result of the breaking or slackening of the suspension members.

Where the travel exceeds forty (40) feet, driving machines having hand-operated brakes shall also be equipped with an automatic speed retarder.

SECTION 603 — CAPACITY AND LOADING

Rule 603.1 Capacity and Loading

603.1a *Minimum Rated Load.*

The rated load of hand elevators shall be not less than fifty (50) pounds per square foot of net inside car area.

603.1b *Capacity Plate.*

A metal plate shall be fastened in a conspicuous place in the elevator car and shall bear the following information in not less than one-quarter (¼) inch letters or numerals, stamped, etched or raised on the surface of the plate:

1 Rated load in pounds.
2 The maximum number of passengers to be carried based on one hundred and fifty (150) pounds per person (if passenger elevator).
3 Suspension data required by Rule 610.5.

SECTION 604 — LOAD AND CAR SAFETY TEST

Rule 604.1 Tests Required

A rated-load test and a test of car safety (where provided), with rated load in the car, shall be made of every new elevator before it is placed in regular service.

SECTION 605 — GUIDE RAILS AND FASTENINGS

Rule 605.1 Material and Finish

Car and counterweights shall be provided with guide rails of steel or straight-grained seasoned wood free from knots, shakes, dry rot or other imperfections.

Guide rails for sidewalk elevators shall be of steel. The guiding surfaces of the guide rails for elevators equipped with car safeties shall be finished smooth.

Rule 605.2 Strength of Rails and Fastenings

Guide rails shall be securely fastened with through bolts or clips of such strength, design and spacing that:

a The guide rails and their fastenings shall not deflect more than one-quarter (¼) inch under normal operation.

b The guide rails and their fastenings shall withstand the application of the safety, where provided, when stopping the car with rated load or when stopping the counterweight.

Rule 605.3 Extension of Guide Rails at Top and Bottom of Hoistway

Car and counterweight guide rails shall rest on suitable supports and extend at the top of the hoistway sufficiently to prevent the guide shoes from running off the guide rails in case the car or counterweight travels beyond the terminal landings.

SECTION 606 — COUNTERWEIGHTS

Rule 606.1 Counterweight Construction

Sections of counterweights, whether carried in frames or not, shall be secured by at least two (2) tie rods passing through holes in the sections. The tie rods shall have lock nuts at each end, secured by cotter pins.

SECTION 607 — DRIVING MACHINES AND SHEAVES

Rule 607.1 Factors of Safety

The factors of safety, based on static loads, to be used in the design of driving machines and sheaves shall be not less than eight (8) for wrought iron or wrought steel and ten (10) for cast iron or other materials.

Rule 607.2 Driving-Machine Brakes

Driving machines shall be equipped with a hand brake or an automatic brake operating in either direction of motion of the elevator, and capable of stopping and holding the car with its rated load. When the brake has been applied, it shall remain in the "On" position until released by the operator.

SECTION 608 — OVERHEAD BEAMS AND SUPPORTS, AND ACCESS TO MACHINES AND SHEAVES

Rule 608.1 Overhead Beams and Supports

Overhead beams and their supports shall conform to the requirements of Section 105.

Rule 608.2 Access to Machines and Sheaves

Adequate and permanent means of access shall be provided to machines and sheaves for maintenance and inspection (See Rule 101.3).

SECTION 609 — POWER ATTACHMENTS

Rule 609.1 Power Attachments Prohibited

Elevators shall not be equipped with any means or attachment for applying electric or other power unless the elevator is permanently and completely converted into a power elevator conforming to all requirements of this Code for electric or hydraulic elevators.

SECTION 610 — SUSPENSION MEANS

Rule 610.1 Type and Number Required

Suspension means shall consist of not less than two (2) wire ropes or chains.

Rule 610.2 Factor of Safety

The factor of safety used in determining the size and number of the suspension members shall be not less than five (5), based on the weight of the car and its rated load.

Rule 610.3 Length of Suspension Members

The length of suspension members shall be such as to provide the minimum top car and counterweight clearances specified in Rule 600.4.

Rule 610.4 Securing of Drum Ends, and Turns on Drum

Drum ends of suspension members shall be secured to the inside of the drum by clamps or babbitted sockets, and there shall be not less than one complete turn of the suspension members around the winding drum when the car or counterweight is resting on its buffers.

Rule 610.5 Suspension-Member Data

The capacity plate required by Rule 603.1b shall show the size, rated ultimate strength and material of the suspension members. The date of installation of the suspension members shall be shown on a metal tag attached to the suspension fastening.

PART VII

HAND AND POWER DUMBWAITERS

SCOPE

**This part applies to hand and power dumbwaiters.

It is not intended that this part apply to hand dumbwaiters serving not more than two (2) consecutive floors and having a capacity of twenty (20) pounds or less and a car platform area of not more than two (2) square feet.

SECTION 700 — HOISTWAYS, HOISTWAY ENCLOSURES AND RELATED CONSTRUCTION

Rule 700.1 Applicable Requirements

Hoistways, hoistway enclosures and related construction shall conform to the requirements of Part I except for the following rules and sections which do not apply:

Rule 100.1d	Multiple Hoistways.
Rule 100.1e	Strength of Enclosure.
Rule 100.3	Floor Over Hoistways.
Rule 100.6	Projections, Recesses and Setbacks in Hoistway Enclosures.
Rule 101.1a	Enclosures Required for Elevators Having Fire-Resistive Hoistways.
Rule 101.1b	Enclosures Required for Elevators Having Non-Fire-Resistive Hoistway Enclosures.
Rule 101.2	Equipment in Machine Rooms.
Rule 101.3c	Requirements for Means of Access.
Rule 101.4	Head Room in Machine Rooms and Overhead Machinery Spaces.
Rule 101.5b	Ventilation for Machinery and Control Equipment.
Section 103	*Location and Guarding of Counterweights.*
Section 104	*Guarding of Exposed Equipment.*
Section 106	*Pits.*

Section 107	*Bottom and Top Clearances and Runbys for Elevator Cars and Counterweights.*
Section 108	*Horizontal Car and Counterweight Clearances.*
Rule 109.1	Hoistways Not Extending to Lowest Floor of the Building. This rule applies to all dumbwaiters except those having a rated load of twenty-five (25) pounds or less.
Rule 110.2	Types of Entrances.
Rule 110.3	Closing of Hoistway Doors.
Rule 110.4	Location of Horizontally Sliding or Swinging Hoistway Doors.
Rule 110.5	Projection of Entrances and Other Equipment Beyond the Landing Sills.
Rule 110.6	Opening of Hoistway Doors from Hoistway Side.
Rule 110.7	Hoistway-Door Vision Panels.
Rule 110.9	Hoistway-Door Locking Devices and Hoistway-Door Power Operators.
Rule 110.10	Landing-Sill Guards, Landing-Sill Illumination, Hinged Landing-Sills and Tracks on Landings.
Rule 110.12c	Rails (For Vertical Slide Type Entrances).
Rule 110.12d-2	Panels (Truckable Sill Requirement). Does not apply to dumbwaiter entrances located above the level of the floor.
Rule 110.12d-4	Panels (Overlap).
Rule 110.12g	Sill Guards.
Section 111	*Hoistway-Door Locking Devices, Car Door or Gate Electric Contacts, Hoistway Access Switches and Elevator Parking Devices.*
Section 112	*Power-Operation, Power-Opening, and Power-Closing of Hoistway Doors and Car Doors or Gates.*

Rule 700.2 Enclosures for Machine Rooms and Machinery Spaces

Hand and power dumbwaiter machines and their control equipment may be located inside the hoistway enclosure at the top or bottom without intervening enclosures or platforms.

Power dumbwaiter machines and control equipment located outside the hoistway shall be enclosed as required for electric elevators by Rules 101.1a and 101.1b except that control equipment located outside the hoistway may be enclosed in a metal cabinet equipped to prevent access by unauthorized persons.

Rule 700.3 Pits

Pits are not required.

Rule 700.4 Types of Entrances

700.4a *For Power Dumbwaiters.*

Entrances shall be one of the following types:

1 Horizontal slide, single- or multi-section.
2 Swing, single-section.
3 Combination horizontal slide and swing.
4 Center-opening two-section horizontal swing, subject to the restrictions of Rule 110.2c.
5 Vertical slide bi-parting counterbalanced.
6 Vertical slide counterweighted, single- or multi-section.

NOTE: See Rule 110.4 for location of horizontally sliding and swinging doors in relation to the edge of the landing sill.

700.4b *For Hand Dumbwaiters.*

Entrances shall be one of the following types:

1 Manually operated vertical slide counterweighted, single- or multi-section.
2 Manually operated vertical slide bi-parting counterbalanced.

Rule 700.5 Closing Hoistway Doors of Hand Dumbwaiters

All doors shall be kept closed except the door at the floor at which the car is being operated or is being loaded or unloaded.

Manually operated doors shall be equipped with approved devices to close them automatically when released by heat. Self-closing doors may be equipped with hold-open devices provided that such devices shall be equipped with fusible links which will release the doors in case of excessive heat.

Rule 700.6 Signs on Hoistway Doors of Hand Dumbwaiters

Every hoistway door shall have conspicuously displayed on the landing side in letters not less than two (2) inches high, the words: "DANGER — DUMBWAITERS — KEEP CLOSED".

Rule 700.7 Size and Location of Hoistway-Door Openings

700.7a *For Power Dumbwaiters.*

The size and location of door openings shall conform to the following:

1 *Size of Openings.* The width and height of door openings shall not exceed the width and height of the car by more than one (1) inch in each dimension.

EXCEPTION: One door opening may be of sufficient size to permit installing and removing the car, but shall be not more than four (4) feet nine (9) inches in height.

2 *Location of Door Opening.* The bottom of the door opening shall be not less than twenty-four (24) inches above the floor.

EXCEPTIONS:

(1) Undercounter dumbwaiters.

(2) Dumbwaiters where load is handled on wheel trucks.

(3) Dumbwaiters having hoistway doors equipped with hoistway door interlocks.

(4) Where the sill of the dumbwaiter landing is within five (5) feet of the pit floor.

700.7b *For Hand Dumbwaiters.*

The width of the door opening shall not exceed the width of the car by more than six (6) inches, and the maximum height of the opening for any height of car shall be fifty-four (54) inches. The bottom of the door openings shall be not less than twenty-four (24) inches above the floor at each landing; except that for the upper landing of undercounter dumbwaiters, the bottom of the opening shall be not less than four (4) inches above the floor.

Rule 700.8 Rails for Entrances, Vertical Slide Type

The panel guide rails shall conform to the requirements of Rule 110.12c, except that they may be fastened only to the entrance frame.

Rule 700.9 Overlap of Entrance Panels for Entrances, Vertical Slide Type

The entrance panels with their attachments shall overlap the entrance frame and sill by not less than one-half (½) inch.

Rule 700.10 Hoistway-Door Locking Devices

700.10a *For Power Dumbwaiters.*

Hoistway doors shall be provided with hoistway-unit system hoistway-door combination mechanical locks and electric contacts conforming to the requirements of Rule 111.4c, 111.4d, 111.6 and 111.8b.

EXCEPTIONS: Hoistway door interlocks shall be provided at landings where the bottom of the door opening is less than twenty-four (24) inches above the floor other than the following:

(1) Undercounter dumbwaiters.

(2) Dumbwaiters not accessible to the general public where the load is handled on wheel trucks.

(3) At landings where the landing sill is within five (5) feet of the pit floor.

700.10b *For Hand Dumbwaiters.*

Hoistway doors shall be provided with locking devices as follows:

1 *Door Latches:* Hoistway doors shall be provided with spring-type latches to hold them in the closed position. Such latches may be released from both the hoistway and landing side, irrespective of the position of the car.

2 *Gate Locks:* Hoistway gates required with horizontally sliding or swinging type hoistway doors shall be provided with hoistway-gate separate mechanical locks.

SECTION 701 — CARS

Rule 701.1 Construction of Cars

Cars shall conform to the following requirements:

a They shall be of solid or openwork construction, and of such strength and stiffness that they will not deform appreciably when the load leans or falls against the sides of the car.

b Non-metal cars shall be reinforced with metal from the bottom of the car to the point of suspension.

c Metal car sections shall be riveted, welded or bolted together.

d Cars may be provided with hinged, permanent or removable shelves.

e The total inside height of the car shall not exceed four (4) feet.

f Cars shall be provided with a platform.

EXCEPTION: The platform floor may be made hinged or removable or may be omitted in non-residential buildings, subject to the approval of the enforcing authority.

NOTE: The omission of the platform floor is frequently desired by department stores, dress manufacturers, clothing manufacturers and similar establishments in order to carry dresses, coats, etc. which are longer than the four (4) foot height permitted for the car.

SECTION 702 — CAPACITY AND LOADING

Rule 702.1** Structural Capacity Load

Driving machines, car and counterweight suspension means, and overhead beams and supports shall be designed and installed to sustain the car with a structural capacity load not less than that specified in Table 702.1 based on the inside net platform area or the rated load whichever is greater with factors of safety specified in the respective rules applying to such parts. The motive power shall not be required to be sufficient to lift the structural capacity load.

Table No. 702.1

Minimum Allowable Structural Capacity Load Corresponding to Inside Net Platform Area

Net Platform Area in Square Feet	Structural Capacity Load in Pounds
4	100
5	150
6¼	300
9	500

Rule 702.2 Maximum Rated Load and Maximum Inside Net Platform Area**

702.2a** *Maximum Rated Load.*

The rated load shall not exceed five hundred (500) pounds.

702.2b** *Maximum Inside Net Platform Area.*

The inside net platform area shall not exceed nine (9) square feet.

Rule 702.3 Capacity Plate

A metal plate shall be fastened in a conspicuous place in the car and shall indicate the rated load in letters and numerals not less than one-quarter (¼) inch high, stamped, etched or raised on the surface of the plate.

SECTION 703 — CAR AND COUNTERWEIGHT SAFETIES

Rule 703.1 Where Required

Car and counterweight safeties shall not be required except for protection of spaces below hoistways (See Rule 109.1). Where required they may be located in the car crosshead.

SECTION 704 — DRIVING MACHINES AND SHEAVES

Rule 704.1 Types of Power Driving Machines Permitted

Driving machines shall be one of the following types:
a Winding-Drum.
b Traction.
c Rack and Pinion.
d Screw.
e Direct-Plunger.
f Belt-Drive — Single Belt.
g Chain-Drive.
h** Roped-Hydraulic.

Rule 704.2 Factors of Safety of Driving Machines and Sheaves

Driving machines and sheaves shall be designed with a factor of safety, based on the static load (the rated load plus the weight of the car, ropes, counterweights, etc.) of not less than:
a Six (6) for steel, and
b Nine (9) for cast iron and other materials.

Rule 704.3 Belt-Drive Machines

Belts used as the driving means between the motor and the machine of power dumbwaiters shall conform to the following requirements:

a Where flat belts are used, the rated speed shall be not more than fifty (50) feet per minute.

b Where multiple V-belts are used, the rated speed shall be not more than one hundred and fifty (150) feet per minute.

Rule 704.4 Driving-Machine Brakes

Electric and hand driving machines shall be equipped with brakes as follows:

a Electric driving machines shall have electrically released brakes applied automatically by springs in compression or by gravity when power is removed from the motor.

b Hand driving machines shall be equipped with hand brakes or automatic brakes which will sustain the car and its rated load. When the brake is applied, it shall remain locked in the "On" position until released by the operator.

EXCEPTION: For rated loads of twenty (20) pounds or less, the brake may be omitted provided the machine has sufficient friction to hold the car and its rated load at any floor.

Rule 704.5 Hydraulic Dumbwaiters**

Hydraulic driving machines, valves, supply piping, fittings and tanks shall conform to the requirements of Sections 302, 303 and 304.

EXCEPTION: When roped-hydraulic machines are used, design need not conform to the requirements of Rules 302.1, 302.2 and 302.3c.

SECTION 705 — CAR AND COUNTERWEIGHT GUIDES AND GUIDE FASTENINGS

Rule 705.1 Guides for Dumbwaiters Having a Capacity of More Than Twenty (20) Pounds

Car and counterweight guide rails shall be of metal, wood, or metal and wood bolted together.

Rule 705.2 Guides for Dumbwaiters Having a Capacity of Twenty (20) Pounds or Less

Car and counterweight guides shall be of metal, wood, wood and metal bolted together, metal tubes, or spring-steel wires maintained in tension.

Rule 705.3 Use of One Set of Guide Rails for Car and Counterweight

The same set of guide rails may be used for both the car and counterweight.

Rule 705.4 Guide Fastenings and Joints

Guides shall be securely fastened to the hoistway.

Guide-rail joints shall be either tongue and groove or doweled and fitted with splice plates.

SECTION 706 — COUNTERWEIGHTS

Rule 706.1 Design of Counterweights

Counterweights for dumbwaiters, having a capacity of more than one hundred (100) pounds and a rated speed of more than one hundred (100) feet per minute, shall be of either solid or sectional construction. If made in sections, the sections shall be secured by not less than two (2) tie rods passing through holes in all sections except where metal counterweight frames are provided. Tie rods shall have lock nuts secured by cotter pins.

SECTION 707 — MEANS OF SUSPENSION AND FASTENINGS

Rule 707.1** Power Dumbwaiters

Cars and counterweights, except for dumbwaiters having direct plunger-hydraulic or rack and pinion or screw-type driving machines, shall be suspended by one or more iron- or steel-wire hoisting ropes or chains secured to the car or counterweight or rope hitch by babbitted sockets, rope clamps, or equally substantial fastenings.

Wire ropes may have marlin covers.

Rule 707.2 Types of Chains Permitted for Power Dumbwaiters

Chains where used shall be roller, block, or multiple-link silent type.

Rule 707.3 Factors of Safety for Power Dumbwaiters

The factor of safety, based on the static load, of car and counterweight suspension means shall be not less than the value specified in Table No. 707.3 for actual speed of rope or chain corresponding to the rated speed of the dumbwaiter.

Table No. 707.3

Factors of Safety for Wire Rope and for Chains

Rope or Chain Speed Feet per Minute	Factor of Safety For Ropes	Factor of Safety For Chains
50	4.8	6.0
100	5.2	6.5
150	5.5	6.9
200	5.9	7.4
250	6.2	7.8
300	6.6	8.3
350	7.0	8.8
400	7.3	9.1
450	7.7	9.6
500	8.0	10.0

Rule 707.4 Hand Dumbwaiters

707.4a *Rated Loads Exceeding Seventy-Five (75) Pounds.*

Dumbwaiters having a rated load exceeding seventy-five (75) pounds shall be suspended by steel wire ropes or chains having a factor of safety of not less than four and one-half (4½).

707.4b *Rated Loads of Seventy-Five (75) Pounds or Less.*

Dumbwaiters having a rated load of seventy-five (75) pounds or less may be suspended by manila or braided-cotton ropes having a factor of safety of not less than six (6).

Rule 707.5 Number of Ropes or Chains Required

The number of suspension ropes or chains shall be determined by multiplying the static load (weight of the car plus rated load plus the weight of the hoisting ropes or chains) by the required factor of safety, and dividing the result by the manufacturer's rated ultimate strength of one of the ropes or chains of the size and construction to be used.

Where two-to-one roping is used, one-half (½) the static load shall be used in the formula.

Rule 707.6 Splicing of Wire Ropes

Wire ropes shall not be lengthened or repaired by splicing.

Rule 707.7 Fastening of Drum Ends, and Turns on Drum

The winding-drum ends of car and counterweight ropes or chains shall be secured inside the drum, and there shall be not less than one turn of the rope or chain on the drum when the car or counterweight has reached the extreme limit of its overtravel.

SECTION 708 — CONTROL AND OPERATION OF POWER DUMBWAITERS

Rule 708.1 Types of Operation Permitted

Operation shall be of the automatic or continuous-pressure type.

Rule 708.2 Winding-Drum Machine Slack-Rope Switches

Winding-drum machines for dumbwaiters having a travel of more than thirty (30) feet and a rated load of more than one hundred (100) pounds, shall be equipped with a slack-rope switch which will remove the power from the motor and brake if the car is obstructed in its descent.

SECTION 709 — TERMINAL STOPPING DEVICES FOR POWER DUMBWAITERS

Rule 709.1 Where Required

A device shall be provided to remove power automatically from the motor and the brake at the top and bottom terminal independently of the operation of the normal operating device. This device may be located on the machine, on the car or in the hoistway.

NOTE: The normal terminal stopping device may be used as a normal stopping means.

PART VIII
ESCALATORS

SCOPE

**This part applies to escalators.

SECTION 800 — PROTECTION OF FLOOR OPENINGS

Rule 800.1 Protection Required

Floor openings for escalators shall be protected against the passage of flame, smoke or gases in the event of fire.

Rule 800.2* Escalators Accredited as a Required Means of Egress

Escalators accredited as a required means of egress shall conform to the applicable requirements of the local laws and ordinances.

Rule 800.3 Escalators Not Accredited as a Required Means of Egress

Escalators not accredited as a required means of egress shall have the floor openings protected by any one of the following generally recognized methods or by other methods which may be established as adequate by competent agencies:

a* Full enclosures.

b* Kiosks conforming to the requirements of Life Safety Code NFPA No. 101-1970 (6-125).

c* Automatic rolling shutters conforming to the requirements of Life Safety Code NFPA No. 101-1970 (6-124).

d Sprinkler method (only where the building area is fully protected by a supervised automatic sprinkler system) consisting of individually operating sprinklers so spaced as to protect the exposed sides of the opening. A heat apron shall be provided to bank heat around the sprinkler heads adjacent to the opening. The lower edge of the apron shall be not less than six (6) inches below the bottom of the sprinkler heads.

In buildings of fifty thousand (50,000) cubic feet or less, it is recommended that the sprinkler arrangement be supplemented by an automatically controlled exhaust system to create a down draft through the opening.

NOTE: In buildings of this size excessive quantities of smoke or gas may pass through the opening before the temperature rises to a point where the sprinklers will operate.

e* Spray nozzles (only where building area is fully protected by a supervised automatic sprinkler system) conforming to the requirements of Life Safety Code NFPA No. 101-1970 (6-123).

EXCEPTION: The floor opening protection specified is not required for escalators that are not accredited as a required means of egress, and which connect floors permitted by local laws and ordinances to be connected by unenclosed stairways.

NOTE: It is not the intent to recommend one method over another nor to prohibit consideration of other methods which may be established by competent agencies.

SECTION 801 — PROTECTION OF TRUSSES AND MACHINE SPACES AGAINST FIRE

Rule 801.1 Protection Required.

The sides and undersides of escalator trusses and machinery spaces shall be enclosed in fire-resistive materials. Means may be provided for adequate ventilation of the driving machine and control spaces.

SECTION 802 — CONSTRUCTION REQUIREMENTS

Rule 802.1 Angle of Inclination

The angle of inclination shall not exceed thirty (30) degrees from the horizontal.

Rule 802.2 Width

The width between balustrades shall be measured on the incline at a point twenty-seven (27) inches vertically above the nose line of the steps, and shall not be less than the width of the step. It shall not exceed the width of the step by more than thirteen (13) inches with a maximum of six and one-half (6½) inches on either side of the escalator (See Rule 802.5b for step width requirements and schematic diagram in Appendix D).

Rule 802.3 Balustrades

802.3a** *Construction.*

A solid balustrade shall be provided on each side of the moving steps. The balustrade on the step side shall have no areas or moldings depressed or raised more than one-quarter (¼) inch from the parent surface. Such areas or moldings shall have all boundary surfaces beveled unless parallel to the direction of travel.

Balustrades shall be designed to resist the simultaneous application of a lateral force of forty (40) pounds per lineal foot and a vertical load of fifty (50) pounds per lineal foot, both applied to the top of the balustrade.

The skirt panel adjacent to the step shall be constructed of material having a smooth surface. Embossed, perforated or roughly textured materials shall not be used.

802.3b** *Use of Glass or Plastic in Balustrades.*

Glass or plastic panels, if used in balustrades, shall conform to the requirements of ANSI Z97.1-1966, except that there shall be no requirement for the panels to be transparent.

EXCEPTION: Plastic material bonded to a basic supporting panel.

802.3c** *Clearance Between Balustrades and Steps.*

The clearance on either side of the steps between the step tread and the adjacent skirt panel shall be not more than three-eighths (3/8) inch.

802.3d *Change in Width Between Balustrades.*

The width between the balustrades in the direction of travel shall not be changed abruptly nor by more than eight (8) percent of the greatest width.

In changing from the greater to the smaller width, the maximum allowable angle of change in the balustrading shall be fifteen (15) degrees from the line of travel.

802.3e** *Guards at Ceiling Intersection.*

A solid guard shall be provided in the intersecting angle of the outside balustrade (deck board) and the ceiling or soffitt.

EXCEPTION: Where the intersection of the outside balustrade (deck board) and the ceiling or soffitt is more than twenty-four (24) inches from the centerline of the handrail.

The vertical face of the guard shall project at least fourteen (14) inches horizontally from the apex of the angle.

The exposed edge of the guard shall be rounded to eliminate shear hazard. Guards may be of glass or plastic provided they meet the requirements of Rule 802.3b.

Rule 802.4 Handrails

802.4a *Type Required.*

Each balustrade shall be provided with a handrail moving in the same direction and at substantially the same speed as the steps.

802.4b *Extension Beyond Combplates.*

Each moving handrail shall extend at normal handrail height not less than twelve (12) inches beyond the line of points of the combplate teeth at the upper and lower landings.

802.4c *Guards.*

Hand or finger guards shall be provided at the point where the handrail enters the balustrade.

802.4d *Distance Between Handrails.*

The horizontal distance between the centerlines of the two handrails, measured on the incline, shall not exceed the width between the balustrades (See Rule 802.2) by more than six (6) inches, with a maximum of three (3) inches on either side of the escalator (See schematic diagram in Appendix D).

Rule 802.5 Step Treads

802.5a *Material and Type.*

Step frames shall be made of noncombustible material.

Step treads shall be horizontal and made of noncombustible material which will afford a secure foothold.

EXCEPTION: Step tread material may be slow burning type if covered on the underside with sheet metal not less than No. 27 U.S. gage or with equivalent fire-resistive material.

802.5b *Dimensions of Steps.*

The depth of any step tread in the direction of travel shall be not less than fifteen and three-quarter (15¾) inches, and the rise between treads shall be not more than eight and one-half (8½) inches. The width of a step tread shall be not less than sixteen (16) inches nor more than forty (40) inches (See schematic diagram in Appendix D).

802.5c** *Slotting of Step Risers.*

The step riser shall be provided with vertical cleats which shall mesh with slots on the adjacent step tread as the steps make the transition from incline to horizontal.

802.5d** *Slotting of Step Treads.*

The tread surface of each step shall be slotted in a direction parallel to the travel of the steps. Each slot shall be not more than one-quarter (¼) inch wide and not less than three eighths (⅜) inch deep; and the distance from center to center of adjoining slots shall be not more than three-eighths (⅜) inch.

Slots shall be so located on the step tread surface as to form a cleat on each side of the step tread adjacent to the skirt panel.

Rule 802.6 Combplates

802.6a *Where Required.*

There shall be a combplate at the entrance and at the exit of every escalator.

802.6b *Design of Combplates.*

The combplate teeth shall be meshed with and set into the slots in the tread surface so that the points of the teeth are always below the upper surface of the treads.

Combplates shall be adjustable vertically. Sections forming the combplate teeth shall be readily replaceable.

Rule 802.7 Trusses or Girders

The truss or girder shall be designed to safely sustain the steps and running gear in operation. In the event of failure of the track system it shall retain the running gear in its guides.

Where tightening devices are operated by means of tension weights, provision shall be made to retain these weights in the truss if they should be released.

Rule 802.8 Step Wheel Tracks

Step wheel tracks shall be designed so as to prevent displacement of the steps and running gear if a step chain breaks.

Rule 802.9 Rated Load

The rated load, in pounds, shall be computed by the following formula:

$$\text{RATED LOAD} = 4.6\,WA$$

Where W is the width in inches between the balustrades (See Rule 802.2) and A the horizontal distance in feet between the upper and lower combplate teeth.

Rule 802.10 Design Factors of Safety**

The factors of safety, based on the static loads, shall be at least the following:

- a Trusses and all supporting structure, including tracks, shall conform to the AISC Specifications for Design, Fabrication and Erection of Structural Steel for Buildings, 1963.
- b For driving machine parts:
  - 1 Where made of steel or bronze, eight (8)
  - 2 Where made of cast iron or other materials, ten (10).
- c For power-transmission members, ten (10).

EXCEPTION: Step chains composed of cast-steel links which, if thoroughly annealed, shall be permitted with a factor of safety of at least twenty (20).

SECTION 803 — RATED SPEED

Rule 803.1 Limits of Speed

The rated speed shall be not more than one hundred and twenty-five

(125) feet per minute, except that higher speeds may be permitted subject to the approval of the enforcing authority.

SECTION 804 — DRIVING MACHINE, MOTOR AND BRAKE

Rule 804.1 Connection Between Driving Machine and Main Drive Shaft

The driving machine shall be connected to the main drive shaft by toothed gearing, a coupling, or a chain.

Rule 804.2 Driving Motor

An electric motor shall not drive more than one escalator.

Rule 804.3 Brake

Each escalator shall be provided with an electrically released, mechanically applied brake capable of stopping the up or down traveling escalator with any load up to rated load. This brake shall be located either on the driving machine or on the main drive shaft.

Where a chain is used to connect the driving machine to the main drive shaft, a brake shall be provided on this shaft. It is not required that this brake be of the electrically released type if an electrically released brake is provided on the driving machine.

SECTION 805 — OPERATING AND SAFETY DEVICES

Rule 805.1 General

Operating and safety devices conforming to the requirements of this Section shall be provided.

805.1a *Starting Switch.*

Starting switches shall be of the key-operated type and shall be located within sight of the escalator steps.

805.1b *Emergency Stop Buttons.*

Emergency stop buttons or other type of manually operated switches having red buttons or handles shall be accessibly located at or near the top and bottom landings of each escalator, and shall be protected against accidental operation. An escalator stop button with an unlocked cover over it which can readily be lifted or pushed aside shall be considered accessible. The operation of either of these buttons or switches shall interrupt the power to the driving machine. It shall not be possible to start the driving machine by these buttons or switches.

805.1c *Speed Governor.*

A speed governor shall be provided, the operation of which will cause the interruption of power to the driving machine should the speed of the steps exceed a predetermined value, which shall be not more than forty (40) percent above the rated speed.

EXCEPTION: The overspeed governor is not required where a low slip alternating current squirrel cage induction motor is used and the motor is directly connected to the driving machine.

NOTE: The governor may be omitted in such case even though a chain is used to connect the sprocket on the driving machine to the sprocket on the main drive shaft as permitted by Rule 804.1.

805.1d *Broken Step-Chain Device.*

A broken step-chain device shall be provided, that will cause the interruption of power to the driving machine if a step chain breaks, and, where no automatic chain tension device is provided, if excessive sag occurs in either step chain.

****805.1e** *Application of an Electrically Released Brake.*

An electrically released brake shall automatically stop the escalator when any of the safety devices required by Rules 805.1b, 805.1c, 805.1d, 805.1f, 805.1h and 805.1i function.

805.1f *Broken Drive-Chain Device.*

Where the driving machine is connected to the main drive shaft by a chain, a device shall be provided which will cause the application of the brake on the main drive shaft if the drive chain parts.

805.1g *Stop Switch in Machinery Spaces.*

A stop switch shall be provided in each machinery space where means of access to the space is provided. This switch, when opened, shall cause electric power to be removed from the escalator driving machine motor and brake. The stop switches shall:

1 Be of the manually opened and closed type.
2 Be conspicuously and permanently marked, "STOP."
3 Be positively opened mechanically and their opening shall not be solely dependent on springs.

EXCEPTION: Machinery space in which main line disconnect switch is located.

805.1h** *Skirt Obstruction Device.*

Means shall be provided to cause the opening of the power circuit to the escalator driving machine motor and brake should an object become wedged between the step and the skirt panel as the step approaches the lower combplate.

805.1i** *Rolling Shutter Device.*

Rolling shutters (See Rule 800.3 subdivision c), if used, shall be provided with a device which shall be actuated as the shutters begin to close to cause the opening of the power circuit to the escalator driving machine motor and brake.

SECTION 806 — LIGHTING, ACCESS AND ELECTRICAL WORK

Rule 806.1 Lighting of Machine Room

Permanent artificial lighting shall be provided in every machine room. The lighting switch shall be so located that it can be operated without passing over or reaching over any part of the machinery.

Rule 806.2 Lighting of Step Treads

Step treads shall be illuminated throughout their run. The light intensity on the tread surfaces shall be not less than two (2) footcandles.

NOTE: It is desirable that the illumination be of uniform intensity and that it should not contrast materially with that of the surrounding area.

Rule 806.3 Access to Interior

Reasonable access to the interior of the escalator shall be provided for inspection and maintenance.

Rule 806.4 Electrical Work

Electrical work shall conform to the following:

a* *Wiring.*

Electrical conductors shall be encased in rigid metal conduit, electrical metallic tubing or in metal wireways, securely fastened to the supporting structure.

The installation of all electrical wiring shall conform to the requirements of the National Electrical Code, ANSI C1-1968 (NFPA 70-1968).

EXCEPTIONS:

(1) Flexible conduit or armored cables may be used for short runs connecting safety and operating devices to main wellway conductors.

(2) Flexible cables may be used within machine rooms.

b** *Disconnect Means.*

An enclosed fused disconnect switch or circuit breaker arranged to disconnect the power supply to the escalator shall be installed in the space where the controller is located or shall be mounted on the controller. Disconnect switches or circuit breakers shall be of the manually closed multi-pole type.

Circuit breakers where used as a disconnect means shall not be of the instantaneous type and shall not be opened automatically by a fire alarm system.

c *Enclosure of Electrical Parts.*

All electric safety switches and controllers shall be enclosed to protect against accidental contact.

d *Voltage Limitations.*

The maximum system or circuit potential used for escalator operating control and signal circuits, operating and safety equipment, driving-machine motors, electrically released brakes and motor generator sets shall not exceed the following:

1 For operating and signal circuits: three hundred (300) volts except that higher potentials may be used for frequencies of twenty-five (25) through sixty (60) cycles alternating current or for direct current, provided the current in the system cannot under normal conditions exceed eight (8) milliamperes for alternating current nor thirty (30) milliamperes for direct current.

2 For control circuits, driving machine motors, electrically released brakes and motor generator sets: six hundred (600) volts except that higher potentials may be used for driving motors of motor generator sets.

PART IX

MOVING WALKS

SCOPE

**This part applies to moving walks used to transport passengers. This part does not apply to moving walks used as a part of an industrial process or as part of a transportation system consisting of a combination of moving walks and cars.

SECTION 900 — DESIGN REQUIREMENTS

Rule 900.1 Direction of Passage

Passage from a landing to a treadway or vice versa shall be in the direction of treadway travel at the point of passenger entrance or exit.

Rule 900.2 Load Rating

900.2a *Structural.*

For the purpose of structural design, the load rating shall be considered to be not less than one hundred (100) pounds per square foot of exposed treadway.

900.2b *Machinery.*

For the purpose of brake, treadway and power transmission calculations, the load rating shall be considered to be not less than seventy-five (75) pounds per square foot of exposed treadway.

Rule 900.3 Width

900.3a *Limitations.*

The width of a moving walk (the exposed width of treadway) shall be not less than sixteen (16) inches. The maximum width shall depend both on the maximum treadway slope at any point on the treadway, and on the treadway speed. The width shall not exceed the value shown in Table 900.3a.

900.3b *Change in Width.*

The exposed width of treadway shall not be decreased in the direction of travel.

This width requirement applies only to moving walks having entrance to or exit from landings. It is n t intended to preclude development of moving walk systems in which changes in width are made safe and practical by direct passage from one treadway to another, subject to the approval of the enforcing authority.

Table No. 900.3a**

Maximum Treadway Slope at any Point	Maximum Moving Walk Treadway Width in Inches: 90 fpm Max. Treadway Speed	Above 90 to 140 fpm Treadway Speed	Above 140 to 180 fpm Treadway Speed
0 to 5°	Unrestricted	60	40
above 5 to 8°	40	40	40
above 8 to 15°	40	40	Not Permitted

Rule 900.4 Belt Type Treadway

Belt type treadways shall conform to the following:

a *Factor of Safety.* Belt type treadways shall be designed with a factor of safety of not less than five (5) based on ultimate strength.

b *Splices.* Splicing of the treadway belt shall be made in such a manner as to result in a continuous unbroken treadway surface of the same characteristics as the balance of the belt.

c *Grooving.* The treadway surface shall be grooved in a direction parallel to its travel for the purpose of meshing with combplates at the landings. Each groove shall be not more than one-quarter (¼) inch wide at the treadway surface and not less than three-sixteenths (3/16) inch deep; and the distance from center to center of adjoining grooves shall be not more than one-half (½) inch. Sides of grooves may slope for mold draft purposes and may be filleted at the bottom.

Rule 900.5 Belt Pallet Type Treadways

Belt pallet type treadways shall conform to the following:

a *Factor of Safety.* Pallet connecting chains or other connecting devices between pallets, and pallets where part of the propelling system, shall have a factor of safety of not less than ten (10), based on ultimate strength.

b *Splices.* Splicing of the treadway belt shall be made in such a manner as to result in a continuous unbroken treadway surface of the same characteristics as the balance of the belt.

c *Grooving.* The treadway surface shall be grooved in a direction parallel to its travel for the purpose of meshing with combplates at the landings. Each groove shall be not more than one-quarter (¼) inch wide at the treadway surface and not less than three-sixteenths (3/16) inch deep; and the distance from center to center of adjoining grooves shall be not more than one-half (½) inch. Sides of grooves may slope for mold draft purposes and may be filleted at the bottom.

d *Alignment.* Adjacent ends of pallets shall not vary in elevation more than one-sixteenth (1/16) inch. The fasteners that attach the belt to the pallets shall not project above the exposed treadway surface.

Rule 900.6 Pallet Type Treadway

Pallet type treadways shall conform to the following:

a *Factor of Safety.* Pallet connecting chains or other connecting devices, and pallets where a part of the propelling system, shall have a factor of safety of not less than ten (10), based on ultimate strength.

b *Clearance Between Pallets.* The maximum clearance between pallets shall be five thirty-seconds (5/32) inch.

c *Grooving.* The treadway surface of each pallet shall be grooved in a direction parallel to its travel. Each groove shall be not more than one-quarter (¼) inch wide at the treadway surface and not less than three-sixteenths (3/16) inch deep; and the distance from center to center of adjoining grooves shall be not more than one-half (½) inch. Sides of the grooves may slope for mold draft purposes and may be filleted at the bottom.

d *Alignment of Pallet Tread Surfaces.* Adjacent ends of pallets shall not vary in elevation more than one-sixteenth (1/16) inch.

Rule 900.7 Treadway Slope

The slope of a treadway shall not exceed fifteen (15) degrees at any point. (See Rule 900.8 for interdependence of treadway speed and treadway slope.)

Rule 900.8 Speed

Treadway speed shall conform to the following:

a *Maximum Speed.* The maximum speed of a treadway shall depend both on the maximum treadway slope at points of entrance and exit, and on the maximum treadway slope at any other point on the treadway. This speed shall not exceed the lesser of the values determined by Tables 900.8a-1 and 900.8a-2.

Table 900.8a-1

Maximum Treadway Slope at Point of Entrance or Exit	Maximum Treadway Speed in fpm
0 to 3°	180
above 3 to 5°	160
above 5 to 8°	140
above 8 to 12°	130
above 12 to 15°	125

Table 900.8a-2

Maximum Treadway Slope at any Point on Treadway	Maximum Treadway Speed in fpm
0 to 8°	180
above 8 to 15°	140

b* *Higher Speeds.* The maximum speeds listed in Tables 900.8a-1 and 900.8a-2 apply only to moving walks having entrance from or exit to landings. It is not intended to preclude development of moving walk systems in which higher speeds are made safe and practical by direct passage from one treadway to another, subject to the approval of the enforcing authority.

Rule 900.9 Supports

Supports shall conform to the following:

a *Slider Bed.* The carrying portion of the treadway shall be supported for its entire width and length except where it passes from a support to a pulley. The surface of the slider bed shall be reasonably smooth. It shall be so constructed that it will not support combustion.

b *Roller Bed.* Where the treadway is supported on a series of rollers, the combination of roller spacing, belt tension and belt stiffness shall be such that the deflection of the treadway surface, midway between roller, shall not exceed the quantity ninety-four one-thousandths (0.094) inch plus four one-thousandths (0.004) times center to center distance of rollers in inches when measured as follows:

The treadway surface shall be loaded midway between rollers with a twenty-five (25) pound weight concentrated on a cylindrical footpiece two (2) inches long by one (1) inch in diameter placed with

its long axis across the belt. Deflection of this footpiece from its unloaded position shall not exceed the figure obtained above.

The rollers shall be concentric and true running within commercially acceptable tolerances.

c* *Edge Supported Belt.* When the treadway belt is transversely rigid and is supported by rollers along its edges, the following requirements shall apply:

1 With the belt tensioned through the take-up system, the permissible slope of a straight line from the top of a treadway rib adjacent to the centerline of the treadway to the top of a treadway rib adjacent to the balustrade, in a plane perpendicular to the path of the treadway, shall not exceed three (3) percent when the treadway is loaded with a one hundred fifty (150) pound weight on a six (6) inch by ten (10) inch plate located on the centerline of the treadway with the ten (10) inch dimension in the direction of treadway travel.

2 In order to support the treadway in case of localized overload, supports shall be supplied at intervals, not exceeding six (6) feet along the centerline of the treadway. The supports shall be located at a level not more than two (2) inches below the underside of the treadway when it is loaded under test conditions required by the preceding paragraph.

d* *Pallet and Belt Pallet Type.* Pallet wheel tracks shall be so designed and located as to prevent more than one-eighth (⅛) inch vertical displacement of the treadway should the pallet connection means break.

Rule 900.10 Threshold Plates

The entrance to or exit from a moving treadway shall be provided with a threshold plate designed and installed to provide smooth passage between treadway and landing and vice versa and it shall conform to the following:

a *Type Required.* The threshold plate shall be provided with a comb.

b *Clearance.* The threshold comb teeth shall be meshed with and set into the grooves in the treadway surface so the points of the teeth are always below the upper surface of the treadway.

c** *Surface.* The surface of the plate shall afford a secure foothold. The surface shall be smooth from the point of intersection of the comb teeth and upper surface of the treadway, for a distance not exceeding four (4) inches and not less than one (1) inch.

Rule 900.11 Balustrades

Moving walks shall be provided with an enclosed balustrade on each side conforming to the following:

a** *Construction.*

1 Balustrades without moving handrails shall be designed so as to provide no surfaces which can be gripped by a passenger. On the treadway side, the balustrade shall have no areas or moldings depressed or raised more than one-quarter (¼) inch from the parent surface. Such areas or moldings shall have all boundary surfaces beveled unless parallel to the direction of travel. The balustrades shall extend at normal height not less than twelve (12) inches beyond the end of the exposed treadway.

2 Glass or plastic panels, if used in the balustrades shall conform to the requirements of ANSI Z97.1-1966, except that there shall be no requirement for the panels to be transparent.

3 Balustrades shall be designed to resist the simultaneous application of a lateral force of forty (40) pounds per lineal foot and a vertical load of fifty (50) pounds per lineal foot, both applied to the top of the balustrade.

b *Height and Flare.* The height of the balustrade shall be not less than thirty (30) inches measured perpendicular to the treadway surface. At this height, the inner surface of the balustrade shall be located not more than eight (8) inches outside the vertical projected edge of the exposed treadway.

c** *Clearance with Treadway.* If the balustrade covers the edge of the treadway, the clearance between the top surface of the treadway and the underside of the balustrade shall not exceed one-quarter (¼) inch. Where skirt panels are used, the horizontal clearance on either side of the treadway between the treadway and the adjacent skirt panel shall be not more than one-quarter (¼) inch.

Rule 900.12 Guards at Ceiling Intersection**

Where the intersection of the balustrade (deckboard) and the ceiling or soffit is less than twenty-four (24) inches from the centerline of the handrail, a solid guard shall be provided in the intersecting angle. The vertical face of the guard shall have a height of not less than seven (7) inches and the exposed edge shall be rounded. Guards may be of glass or plastic provided they conform to the requirements of ANSI Z97.1-1966, except that there shall be no requirement for the guards to be transparent.

Rule 900.13 Handrails

Handrails shall conform to the following:

a *Number Required.* Two moving handrails shall be provided on each moving walk.

EXCEPTIONS:

(1) Moving walks having a slope of three (3) degrees or less and a speed of seventy (70) feet per minute or less.

(2) Moving walks having a width of twenty-one (21) inches or less; where a single moving handrail may be used.

b *Location.* The moving handrail at both the entrance and exit landings shall extend at normal height not less than twelve (12) inches beyond the end of the exposed treadway. The point at which the moving handrail enters or leaves an enclosure shall be not more than ten (10) inches above the floor line.

c *Handrail Guards.* Hand or finger guards shall be provided at the point where the handrail enters the balustrade.

d *Enclosure.* The moving handrail return run and its driving and supporting machinery shall be fully enclosed.

e *Speed.* Each moving handrail shall move in the same direction and at substantially the same speed as the treadway.

Rule 900.14 Drive, Motor and Brake

900.14a *Connection Between Drive and Main Drive Shaft.*

The driving machine shall be connected to the main drive shaft by toothed gearing, a coupling or a chain.

900.14b* *Brakes Required.*

Each moving walk shall be provided with an electrically released, mechanically applied brake capable of stopping and holding the treadway with any load up to the load rating. The brake shall be located either on the driving machine or on the main drive shaft.

Where a chain is used to connect the driving machine to the main drive shaft, a brake shall be provided on the main drive shaft. It is not required that this brake be of the electrically released type if an electrically released brake is provided on the driving machine.

EXCEPTION: Moving walks which will not run in the down direction by gravity under any load condition up to their load rating with the power supply interrupted do not require brakes.

900.14c* *Application of Brakes.*

Electrically released brakes specified in Rule 900.14b shall stop the treadway automatically upon failure of power or when any of the safety devices specified in Section 901 operate. Brakes on the main drive shaft, if not of the electrically released type, shall be applied should the drive chain part.

900.14d* *Speed Reducers.*

Speed reducers shall meet the requirements for design and application as established for the various types in the appropriate AGMA Practice

Standards, as follows:

420.03-1963 — Helical and Herringbone Gear Speed Reducers
430.03-1963 — Spiral Bevel Gear Speed Reducers
440.03-1959 — Single and Double Reduction Cylindrical-Worm and Helical-Worm Speed Reducers
441.03-1963 — Double Enveloping-Worm Gear Speed Reducers
460.04-1965 — Gearmotors
480.03-1965 — Shaft Mounted Speed Reducers

The loading shall be considered to be uniform and the service to be twenty-four (24) hours per day.

900.14e* *Chain Drives.*

Chain drives shall be of the types covered by the following American National Standards:

ANSI B29.1-1963 — Transmission Roller Chains and Sprocket Teeth
ANSI B29.2-1957 — Inverted Tooth (Silent) Chains and Sprocket Teeth

When operating at the load rating of the treadway, the load imposed on such chains shall not exceed the horsepower rating as established by these standards.

The loading shall be considered to be uniform and the service to be twenty-four (24) hours per day.

900.14f* *V-Belt Drives.*

The load imposed on V-Belt drives, when operating at the load rating of the treadway, shall not exceed the horsepower rating as established by the American National Standard Specification for Multiple V-Belt Drives (ANSI B55.1-1961). The loading shall be considered to be uniform and the service to be twenty-four (24) hours per day.

900.14g *Others.*

Pallet propelling chains and drive components other than those specified shall have a factor of safety of not less than ten (10), based on ultimate strength.

Rule 900.15 Supporting Structure

The supporting structure for the treadway, balustrades, and machinery shall conform to the requirements of the AISC Specification for Design, Fabrication and Erection of Structural Steel for Buildings, 1963.

SECTION 901 — OPERATING AND SAFETY DEVICES, ELECTRICAL EQUIPMENT AND WIRING

Rule 901.1 Devices Required

Operating and safety devices shall be provided conforming to the following requirements:

a *Starting Switch.* Starting switches shall be of the key-operated type and shall be located within sight of the exposed treadway.

b *Emergency Stop Switches.* Emergency stop buttons or other types of manually operated switches having red buttons or handles shall be accessibly located at every entrance to and exit from a moving walk, and shall be protected against accidental operation. The operation of any of these buttons or switches shall interrupt the power to the driving machine and to the brake, where provided. It shall be impossible to start the driving machine by these buttons or switches.

c *Broken Drive-Chain Switch.* Where the driving machine is connected to the main drive shaft by a chain, and where a brake is located on the main drive shaft when required by Rule 900.14b, a device shall be provided which will cause application of the brake should the drive chain part.

d *Speed Governor.* Moving walks required by Rule 900.14b to be equipped with a brake, or which are driven by a direct current motor, shall be provided with a speed governor which will cause the interruption of power to the driving machine and to the brake, where provided, should the speed of the treadway exceed a predetermined speed which shall be not more than forty (40) percent above the maximum designed treadway speed.

*EXCEPTIONS**:*

(1) Moving walks driven by low slip alternating current induction motors directly coupled to the driving machine.

(2) Moving walks driven by low slip alternating current induction motors connected to the driving machine by belts or chains, where the brake is directly coupled to the driving machine and where a device is provided that will cause interruption of power to the motor and apply the brake should the belts or chains lose tension or break.

e *Broken Treadway Device for Belt Pallet Type and Pallet Type.* A device shall be provided which will cause interruption of power to the driving machine and to the brake, where provided, if the connecting means between pallets break.

f *Power Interruption.* Where a device is required to interrupt power, such interruption shall not be subject to intentional delay. The use of a supplemental and independent device with or without intentional delay is permissible.

g* *Stop Switch in Machinery Spaces.* A stop switch shall be provided in each machinery space where means of access to the space is pro-

vided. This switch, when opened, shall cause electrical power to be removed from the driving machine motor and brake.

The stop switches in machinery spaces shall:

1 Be of the manually opened and closed type.
2 Be conspicuously and permanently marked "STOP."
3 Be positively opened mechanically and their opening shall not be be solely dependent on springs.

EXCEPTION: Machinery space in which the main line disconnect switch is located.

h *Rolling Shutter Device.* Rolling shutters (See Rule 902.1b-3) if used, shall be provided with a device which shall be actuated as the shutters begin to close to cause the opening of the power circuit to the moving walk driving machine motor and brake.

Rule 901.2 Electrical Equipment and Wiring

Electrical equipment and wiring shall conform to the following:

a** *Disconnect Means.* An enclosed fused disconnect switch or a circuit breaker arranged to disconnect the power supply to the moving walk shall be installed in the space where the controller is located or shall be located on the controller. Disconnect switches or circuit breakers shall be of the manually closed multipole type. Circuit breakers, where used as the disconnect means shall not be of the instantaneous type and shall not be opened automatically by a fire alarm system.

b* *Wiring and Wiring Methods.* Electrical conductors shall be encased in rigid metal conduit, electrical metallic tubing or in metal wireways, securely fastened to the supporting structure. Flexible conduit or armored cables may be used for connecting safety and operating switches to main wellway conductors. Flexible leads may be used within the machinery spaces. The installation of all electrical wiring shall conform to the requirements of the National Electrical Code ANSI C1-1968 (NFPA 70-1968).

c *Operating and Control Circuit Voltages.* The maximum system or circuit potential shall not exceed:

1 For operating, safety and signal circuits: Three hundred (300) volts except that higher potentials may be used for frequencies of twenty five (25) through sixty (60) cycles alternating current, or for direct current, provided the current in the system cannot under normal conditions exceed eight (8) milliamperes for alternating current or thirty (30) milliamperes for direct current.

2 For control circuits, driving machine motors, electrically released brakes and motor generator set: Six hundred (600) volts except that higher potentials may be used for driving motors of motor generator sets.

d *Enclosure of Electrical Parts.* All electric switches and controllers shall be enclosed to protect against accidental contact.
e *Lighting of Machine Room.* Permanent artificial lighting shall be provided in every machine room.
f *Lighting of Landings.* Landings shall be illuminated with light intensity of not less than five (5) foot candles. The illumination shall be of uniform intensity and should not contrast materially with that of the surrounding area.

SECTION 902 — PROTECTION OF FLOOR OPENINGS

Rule 902.1 Protection Required

Where a moving walk pierces a building floor, the opening shall be protected against the passage of smoke, gases or flame in the event of fire as follows:

a* *Moving Walks Accredited as Required Means of Egress.* Moving walks accredited as required means of egress shall conform to the applicable requirements of local laws and ordinances.

b* *Moving Walks Not Accredited as Required Means of Egress.* Moving walks shall have the floor openings protected by any of the following generally recognized methods or by other methods which may be established as adequate by competent agencies:

1 Full enclosure specified in (a) above.
2 Kiosks conforming to the requirements of Life Safety Code NFPA No. 101-1970 (6-125).
3 Automatic rolling shutters conforming to the requirements of Life Safety Code NFPA No. 101-1970 (6-124).
4 Sprinkler method (in buildings where the area in which the moving walk is located is fully protected by a supervised automatic sprinkler system) consisting of individually operating sprinklers so spaced as to protect the exposed sides of the floor openings. A heat apron shall be provided to bank heat around the sprinkler heads adjacent to the openings. The lower edge of the apron shall be not less than six (6) inches below the bottom of the sprinkler heads.

In buildings of fifty thousand (50,000) cubic feet or less, it is recommended that the sprinkler arrangement be supplemented by an automatically controlled exhaust system to create a down draft through the floor opening.

NOTE: In buildings of this size, excessive quantities of smoke or gas may pass through the openings before the temperature rises to a point where the sprinklers will operate.

5 Spray nozzles (only where the building is fully protected by a supervised automatic sprinkler system) conforming to the requirements of Life Safety Code NFPA No. 101.-1970 (6-123).

EXCEPTION: The floor opening protection is not required for moving walks that are not accredited as required means of egress, and which connect floors permitted by local laws and ordinances to be connected by unenclosed stairways.

NOTE; It is not the intent to recommend one method over another nor to prohibit consideration of other methods which may be established by competent agencies.

SECTION 903 — PROTECTION OF SUPPORTS AND MACHINE SPACES AGAINST FIRE

Rule 903.1 Protection Required

The sides and underside of the supporting structure and the machinery and control spaces shall be enclosed with fire-resistive material. Means may be provided for adequate ventilation of machine and control spaces.

PART X
ACCEPTANCE AND PERIODIC TESTS AND INSPECTIONS, AND MAINTENANCE OF ELEVATORS, DUMBWAITERS, ESCALATORS AND MOVING WALKS

SCOPE

**This part covers acceptance tests and inspections, the periodic tests and inspections, and the maintenance needed to insure the continuing safe operation of the equipment.

SECTION 1000 — ACCEPTANCE TESTS AND INSPECTIONS

Rule 1000.1 Acceptance Tests and Inspections of New Installations and Alterations

1000.1a *Tests and Inspections Required.*

In order to insure safe operation of new elevators, dumbwaiters, escalators and moving walks, such devices shall, on their completion and before being placed in service, be subjected to acceptance tests and inspections in the field to determine that all parts of the installation conform to the applicable code requirements and that all safety equipment functions as required. A similar test and inspection shall be made following a major alteration of an existing installation, provided that acceptance tests of car and counterweight safeties, governors and oil buffers are required only where so specified in Section 1200.

1000.1b *Persons Authorized to Make Acceptance Tests and Inspections.*

Acceptance Tests and Inspections shall be made by the following:

1 Inspections shall be made by an inspector employed by the enforcing authority.
2 The following tests shall be made by the person or firm installing or altering the equipment in the presence of an inspector employed by

the enforcing authority:

a Tests specified in Rules 1000.2 through 1000.5.

b Any tests which:

1 Require rendering any elevator safety devices or equipment temporarily inoperative.

2 Require removal or resetting of devices or equipment.

1000.1c *Acceptance Test and Inspection Requirements.*

Acceptance tests shall be made of all safety devices and equipment to determine that they function as required by the applicable code rules.

All parts of the installation shall be inspected for conformity with the requirements of the applicable code rules.

The Inspectors' Manual, ANSI A17.2, Part II for elevators and Part III for escalators, is recommended as a guide for test and inspection procedures.

Rule 1000.2 Acceptance Test Schedule for Car and Counterweight Safeties and Governors

1000.2a *General Requirements for Type A, B and C Safeties.*

1 *Test Load.* Car safeties shall be tested with rated load in the car.

In making the test of car safeties, the load shall be centered on each quarter of the platform symmetrically with relation to the centerlines of the platform.

Counterweight safeties, where provided, shall be tested with no load in the car.

2 *Governor Tripping Speed.* The tripping speed of the governor shall be measured by means of a tachometer and, if necessary, adjusted to conform to the requirements of Rule 206.2.

3 *Sealing of Governors.* Governors shall be sealed, either before or at the time of the safety test, as required by Rule 206.3. If any change is made in the governor setting during the field test in order to conform to the requirements of Rule 206.2, governors previously sealed shall be resealed immediately following the test.

4 *Governor Overspeed Switch and Car-Safety-Mechanism Switch.* The operation of the governor overspeed switch and the car-safety-mechanism switch shall be checked for conformity with the requirements of Rule 206.4.

5 *Level of Car Platform.* After the safety has stopped the car, the level of the car platform shall be checked for conformity with the requirements of Rule 205.9b.

1000.2b *Tests of Type A Governor-Operated Safeties.*

Type A governor-operated safeties shall be tested by operating the car at its normal speed in the down direction and tripping the governor jaws by hand. A test shall also be made of the inertia application of the safety for conformity with the requirements of Rule 205.8a, by attaching the proper weight to the return run of the governor rope. The manufacturer shall inform the person making the test of the weight necessary to be added to the governor rope when making the inertia application test. This weight shall be that necessary to reproduce inertia operation of the safety, at not more than nine-tenths (9/10) gravity. The inertia application test shall be made with the car stationary and the weight when released shall move the safety parts into contact with the rails. See Appendix A for location of weight to be attached to the governor rope when making the inertia test.

NOTE: Inertia application of the safety on the Type A auxiliary safety plank of Type C safeties is not required.

1000.2c *Tests of Type A Safeties, Without Governors, Operated Only as a Result of the Breaking or Slackening of the Hoist Ropes.*

The operation of this type of safety shall be tested by obtaining the necessary slack rope to cause it to function.

1000.2d *Tests of Type B and C Safeties.*

1 *Tests Required.* Type B and C safeties shall be subjected to overspeed test, with the hoisting ropes attached, by gradually increasing the speed of the car until the governor causes application of the safety.

EXCEPTION: Safeties of elevators equipped with alternating-current driving machine motors, where the car with its rated load does not cause sufficient overspeed when the machine brake is released to trip the governor jaws, shall be tested by operating the car at its normal speed in the down direction and tripping governor jaws by hand (See Rule 1000.2a-2 for test of governor tripping speed).

2 *Operation of Governor Overspeed Switch and Car-Safety-Mechanism Switch During Test.* The overspeed switch on the governor shall be inoperative during the overspeed test. In order to assure that the safety will retard the car with the minimum assistance from the elevator driving machine and to minimize the development of slack rope and fall-back of the counterweight, the switch on the car operated by the car safety mechanism shall, for the duration of the test, be temporarily adjusted to open as close as possible to the position at which the car safety mechanism is in the fully applied position.

3 *Stopping Distances for Type B Safeties.* The stopping distance shall conform to the requirements of Rule 205.3, and shall be determined by measuring the length of the marks made by the safety jaws or

wedges on both sides of each car guide rail, deducting the length of the safety jaw or wedge used and taking the average of the four readings.

4 *Stopping Distances for Type C Safeties.* The stopping distance shall be equal to the stroke of the buffer located between the lower member of the car frame and the auxiliary safety plank, and shall conform to the requirements of Rule 205.8b. After the safety has stopped the car, the level of the auxiliary safety plank shall be checked for conformity with the requirements of Rule 205.8b-6.

5 *Buffer Compression-Switch and Oil-Level Device for Type C Safeties.* Tests shall be made of the buffer compression-switch and oil-level device for conformity with the requirements of Rule 205.8b.

6 *Movement of Governor Rope to Operate Type B Safeties.* The movement of the governor rope to operate the safety mechanism shall be tested for conformity with the requirements of Rule 205.11.

Rule 1000.3 Acceptance Tests of Car and Counterweight Buffers

No acceptance test shall be required for solid or spring type buffers. Oil buffers shall be tested in the field in accordance with the following:

a *Oil Level Test.* The level of the oil shall be tested to determine that it is within the maximum and minimum allowable limits (See Rule 201.4f).

b *Plunger Return Tests.* Car and counterweight buffers, when filled with oil, shall be tested for conformity with the plunger return requirements of Rule 201.4e, as follows:

1 The plunger shall be fully compressed and when released, shall return to the fully extended position within ninety (90) seconds.

2 A weight of fifty (50) pounds shall be placed on the plunger of spring-return-type buffers. The plunger with this weight resting on it shall be depressed two (2) inches and then released. When released, the plunger with the weight resting on it shall return to the fully extended position within thirty (30) seconds. (See Rule 201.4g-2).

EXCEPTION: Existing buffers, where retained, are not required to conform.

c *Load and Speed Tests.* Prior to making this test, load range and maximum speed given on the buffer marking plate (See Rule 201.4k) shall be checked to make sure that the correct buffer has been used.

The car oil buffer shall be tested by running the car with its rated load onto the buffer at rated speed.

The counterweight oil buffer shall be tested by running the counterweight onto its buffer at rated speed with no load in the car.

EXCEPTION: For reduced-stroke buffers, conforming to the requirements of Rule 201.4a-2, this test shall be made at the reduced striking speed permitted therein.

In making these tests, the normal terminal stopping devices shall be made temporarily inoperative; and the final terminal stopping devices shall remain operative, but shall be temporarily relocated if necessary to permit full compression of the buffer during the tests.

Rule 1000.4* Additional Acceptance Tests and Inspection for Hydraulic Elevators

The following additional acceptance tests and inspections shall be made on Hydraulic Elevators:

a A test with no load and a test with rated load in the car to determine the car speed under each condition of loading in both the up and down directions.

b A test check of the working pressure including in the case of pressure tanks a check of the accuracy of the tank pressure gage.

c A test of the pump relief valve or pump cut-off pressure shall be made for conformity with the requirements of Rule 303.2a.

d Inspect flexible hydraulic hose and fitting assemblies and flexible couplings, installed between the check valve or control valve and the cylinder for conformity with the requirements of Rule 303.1d. Under working pressure, observe any leakage, slippage of hose fittings, damage to the outer hose covering sufficient to expose the reinforcement, and distortion or bulging of the hose body. Such conditions are cause for replacement of hose and fitting assembly, or the sealing element of a flexible coupling.

Rule 1000.5 Acceptance Tests of Escalators and Moving Walks

Operating and safety devices for escalators and moving walks required by Section 805 for escalators and by Rule 901.1 for moving walks, shall be tested with no load on the escalator and on the moving walk treadway in accordance with the following:

a *Speed Governor Test.* Where a speed governor is required, the governor shall be tested by operating it by hand. (See Rules 805.1c and 0-1.d)

b *Broken Step-Chain Device for Escalators.* Operation of the broken-step-chain device shall be tested by operating the actuating device by hand. (See Rule 805.1d)

c *Broken Drive-Chain Device.* Operation of the broken drive-chain device, where a drive chain is used shall be tested by operating the actuating device by hand. (See Rule 805.1f and Rule 901.1c).

d *Broken Treadway Device for Belt Type and Pallet Type Moving Walks.* Operation of the broken treadway device shall be tested by operating the actuating device by hand. (See Rule 901.1e)

e *Stop Buttons.* The emergency stop buttons shall be tested by operating them when the escalator and/or the moving walk is in operation for each direction of travel.

SECTION 1001 — PERIODIC TESTS AND INSPECTION

Rule 1001.1 Tests and Inspections of Existing Installations

All existing installations shall be subjected to maintenance tests and inspections on a periodic basis.

EXCEPTION: Installations placed out of service. (See Rule 1001.8)All parts of the equipment shall be inspected and where necessary tested to determine that they are in safe operating condition and that parts subject to wear such as ropes, bearings, gears, car safety and governor parts, buffers, etc., have not worn to such an extent as to affect the safe operation of the installation. Any such worn parts shall be adjusted or replaced.

1001.1a *Inspection Periods.*

It is recommended that periodic inspections and tests be made at intervals not longer than:

1* Six (6) months for power passenger elevators, escalators and moving walks.

2* Twelve (12) months for power freight elevators, hand elevators and power and hand dumbwaiters.

EXCEPTION: Inspection and tests of car and counterweight safeties, governors, and oil buffers specified in Rule 1001.1b.

1001.1b *Car and Counterweight Safety, Governor and Oil Buffer Inspections and Tests.*

Safeties, governors and oil buffers shall be inspected and tested for conformance with the requirements of Rules 1001.2 through 1001.5 at intervals of not more than twelve (12) months unless an inspection made in conformity with the requirements of Rule 1001.1 indicates that the tests should be made at shorter intervals.

EXCEPTION: Test of the following shall be made at each inspection period specified in Rule 1001.1a:

(1) Oil buffer compression switch and oil level device of type C safeties for conformance with the requirements of Rule 205.8b (7) and (8).

(2) Level of the oil in the oil buffer for conformance with the requirements of Rule 1000.3a.

For procedure to be followed in making inspections and tests see the Inspectors' Manual ANSI A17.2.

1001.1c *Persons Authorized to Make Maintenance Inspections and Tests.*

Inspections and tests shall, except for the tests required by Rules 1001.4 and 1001.5 be made by an inspector in the employ of the enforcing authority, by a person or firm authorized by the enforcing authority or by an inspector employed by an accredited insurance company which is the primary insurer of the equipment to be inspected.

The owner or his authorized agent shall have tests required by Rules 1001.3, 1001.4 and 1001.5 made by a person qualified to perform such service in the presence of an inspector in the employ of or authorized by the enforcing authority.

EXCEPTIONS: Where an inspector in the employ of or authorized by the enforcing authority is not available at the time the required tests are made, the person or firm conducting the tests shall:

(1) Submit to the enforcing authority a statement upon a form furnished by them certifying that the tests have been conducted and the results thereof.

(2) Attach to the governor rope a tag marked to show the date of the test and the name of the person or firm who conducted it.

Rule 1001.2 Inspection of Safety Parts

All working parts of car and counterweight safeties shall be inspected to determine that they are in satisfactory operating condition and that the distance between the rail gripping faces of the safety parts is not less than:

a For new elevators having Type A, B, C safeties, as specified in Rule 205.10.

b For existing elevators having steel guide safeties, not less than the thickness of the guide rail plus three thirty-seconds (3/32) inch.

c For existing elevators with wood guide safeties, not less than the thickness of the guide rail plus one-quarter (¼) inch.

Type B safeties shall be operated by hand until the safety jaws contact the guide rail after which the following inspection shall be made:

1 For Type B drum operated safeties which require continual unwinding of the safety drum to fully apply the safety, check the number of turns remaining on the car safety drum. These must be sufficient to insure proper operation of the safety on the test required by Rule 1001.4b or should the safety operate on overspeed.

NOTE: Rule 205.11 requires that three turns shall remain on the drum after application of the safety at overspeed with rated load in the car.

2 For all Type B safeties measure the movement of the governor rope necessary to bring the safety jaws into contact with the guide rail surfaces, which for new elevators shall not exceed the amount specified in Rule 205.11.

NOTE: When resetting drum-operated safeties by means of the wrench in the car, sufficient tension shall be kept in the safety-drum rope to prevent kinking of the rope and to insure that it is wound evenly and uniformly in the drum grooves. The drum must be rewound until no slack remains in the safety rope between the drum and the car releasing-carrier.

For Type C safeties, check the level of the oil in the oil buffer. Operate the buffer compression switch and oil level device by hand to make sure that they conform to the requirements of Rule 205.8b-7 and 205.8b-8.

Rule 1001.3 Inspection of Governor

Governors shall be inspected and operated by hand to determine that all parts, including the rope-grip jaws, operate freely. All bearings, governor-rope-grip jaws, and all rubbing surfaces shall be checked to make sure they are not worn excessively and are free of paint.

A test of the governor tripping speed is not required unless the seal on the governor has been disturbed or the inspection indicates that for other reasons, a retest is necessary. If a retest is made, the governor shall be resealed after the test.

Rule 1001.4 Tests of Safeties

Safeties shall be subjected to the following tests:

a Tests every twelve (12) months.

Safeties shall be subjected to a running test with no load in the car as follows:

1 *Type A, B, or C Governor-Operated Safeties.* The safety shall be operated by tripping the governor by hand with the car operating at the SLOWEST operating speed in the down direction. In this test, the safety shall bring the car to rest promptly. In the case of Type B safeties, the stopping distance is not required to conform to Rule 205.3. In the case of Type C safeties, the oil buffer may or may not compress its full stroke. In the case of Type A, B, or C safeties employing rollers or dogs for application of the safety, the rollers or dogs are not required to operate their full travel. (See note following subdivision 2 of Type B safeties in Rule 1001.2)

2 *Wood Guide Governor Operated Safeties.* The safety shall be tested by tripping the governor by hand with the car at rest and moving the car in the down direction until it is brought to rest by the safety and until the hoisting ropes become slack.

3 *Type A and Wood Guide Safeties Without Governors Operated Only as a Result of the Breaking or Slackening of the Hoisting Ropes.* The operation of this type of safety shall be tested by obtaining the necessary slack rope to cause it to function.

b Tests every five years:

Safeties and their governors shall be inspected and tested as follows:

EXCEPTION: Wood guide safeties.

The car safety and the counterweight safety where provided shall be subjected to the following inspections and tests, in addition to the test required by the applicable rules of Section 1001.

1 Type A safeties and Type A safety parts of Type C safeties shall, prior to the safety tests specified in Rule 1001.4-b2, be inspected and the safety operated by hand to determine that:

a It is in satisfactory operating condition.
b Following hand operation the safety rollers or dogs operate simultaneously and have approximately the same travel.
c There is sufficient remaining travel of the rollers or dogs to bring the car and its rated load to rest from rated speed.

2 The safety tests for type A, B, and C safeties shall be made with rated load in the car by tripping the governor by hand at rated speed.

3 Type B safeties shall stop the car with rated load within the range of stopping distances specified in Rule 205.3.

EXCEPTION: The maximum stopping distance of existing gradual wedge-clamp and drum operated flexible guide clamp safeties with rated load in the car shall conform to the following:

Speed in fpm at which Governor is Tripped	Maximum Stopping Distance in Feet-Inches
175	6—2
200	6—3
300	6—11
400	7—10
500	8—10
600	9—11
700	11—1
800	12—4
900	13—6
1000	14—8
1100	16—0
1200	17—4
1300	18—6
1400	19—8
1500	21—1

4 For Type A Safeties and Type A safety parts of Type C Safeties, there shall be sufficient travel of the safety rollers or dogs remaining after the test required by Rule 1001.4-b2 to bring the car and its rated load to rest on safety application at governor tripping speed.

5 The tripping speed of the governor, and the speed at which the governor overspeed switch, where provided, operates, shall be tested. This may be done by removing the governor rope from the governor sheave and driving the governor by a hand or motor-driven device with a gradual acceleration in order to insure an accurate determination of the tripping speed or by other approved means.

If the tripping speed of the governor does not conform to the requirements of Rule 206.2, it shall be readjusted to conform, after which it shall be resealed.

EXCEPTION: Where the tripping speed of an existing governor cannot be readjusted to conform without rebuilding or replacement in which case it shall be adjusted as closely as possible to Rule 206.2 requirements but with a deviation of not more than twenty-five (25) percent.

A metal tag shall be attached to the safety-releasing carrier in a permanent manner, giving the date of the safety test together with the name of the person or firm who performed the test.

Rule 1001.5 Tests of Car and Counterweight Oil Buffers

Periodic tests of oil buffers shall be made as specified in Rules 1000.3-a and 1000.3-b1.

Every five (5) years, oil buffers shall be tested as specified in Rules 1000.3-a, 1000.3-b1 and 1000.3-c. A metal tag shall be attached to the buffer in a permanent manner, giving the date of the test and the name of the person or firm who performed the test.

Rule 1001.6 Hydraulic Elevators, Additional Inspections and Tests

Maintenance inspections and tests shall be made of all operating elevator and dumbwaiter installations at the intervals hereinafter specified.

1001.6a *Six (6) Months Inspection and Test Period.*

Inspections and tests shall be made at six (6) or twelve (12) months intervals in general conformance with the requirements of the applicable rules in Section 1001.

In addition, the relief valve pump cut-off pressure shall be tested as required by Rule 1000.4-c.

1001.6b *Twelve (12) Month Inspection and Test Period.*

Cylinders which are not exposed to visual inspection shall be tested at intervals no longer than twelve (12) months in the following manner:

a Test the relief valve setting (See Rule 1000.4-c) by first inching the empty car upward to engage the plunger stop ring, or to engage other suitable blocking provided, and then apply pressure from the pump to check the setting.

b Put rated load in the car and locate it at any convenient level.

c Open the disconnect switch and locate the elevation of the platform with respect to a convenient reference.

d After a minimum of two (2) hours, note the position of the platform with respect to the chosen reference.

A change in car position which cannot be accounted for by visible oil leakage or temperature change of the oil indicates a leak in the cylinder or in the underground piping and need for further inspections, tests or repairs.

1001.6c *Three (3) Year Inspection and Test Period.*

Inspections and tests conforming to the following shall be made at intervals no longer than three (3) years.

1 Pressure tanks shall, after being thoroughly cleaned as required by Rule 1002.5b-1, be internally inspected and shall, after such inspection, be subjected to a hydrostatic test with one hundred and fifty (150) percent of working pressure applied for one minute.

2 Piston rods of roped hydraulic elevators and dumbwaiters shall, after being cleaned as required by Rule 1002.5b-2, be exposed and inspected and where pitted or worn to a diameter less than the root diameter of the threads shall be replaced.

3* Inspect flexible hose and fitting assemblies, and flexible couplings, as required by Rule 1000.4-d except under pressure of three (3) times the working pressure for hose and fitting assemblies.

Rule 1001.7 Inspection and Tests for Escalators and Moving Walks

Maintenance and inspection tests of escalators and moving walks shall be made at intervals as specified in Rule 1001.1a.

The tests and inspections shall be made as specified in Rule 1000.5.

Rule 1001.8 Installations Placed Out of Active Service

Where for any reason an installation is placed out of active service (see definitions) so that it cannot be operated for a definite period, the tests and inspections may be discontinued for the out of service period.

Before such installation is again placed in active service, it shall be subjected to tests and inspections in accordance with the requirements of Section 1001 except for the five (5) year and three (3) year (hydraulic) tests. If the out-of-service period exceeds one year, the installation shall also be subjected to the five (5) year and the three (3) year tests.

SECTION 1002 — MAINTENANCE

Rule 1002.1 Lubrication

All parts of the machinery and equipment requiring lubrication should be lubricated at regular periodic intervals with lubricants of a grade as recommended by the manufacturer. The use of excessive amounts of lubricant should be avoided.

1002.1a *Hoisting and Counterweight Wire Ropes.*

For precautions to be taken in lubricating hoisting and counterweight wire ropes, refer to Inspectors' Manual, ANSI A17.2.

1002.1b *Governor Wire Ropes.*

Governor wire ropes shall not be lubricated after installation as the lubricant may interfere with the ability of the governor jaws to stop the governor rope and apply the safety.

1002.1c *Guide Rails.*

Guide rails, except those of elevators equipped with roller or other type guiding members not requiring lubrication, should be kept well lubricated; but an excess of lubricant should be avoided.

Rails on which a lubricant is used should be cleaned down at least once a year. Where necessary, a nonflammable or high-flash-point solvent should be used to remove excess lubricant, lint and dirt which will accumulate on them and which presents a hazard in case of fire in the hoistway.

Where sliding-type safeties are used it is important that guide-rail lubricants, or pre-lubricated or impregnated guide-shoe gibs where used, be of a type recommended by the manufacturer of the elevator which will not reduce the holding power of the car safety (See Rule 205.16).

Rust-preventive compounds such as paint, mixtures of graphite and oil and similar coatings should not be used as they may interfere with and in many cases will prevent proper operation of the car safety. Some substances may even cause complete failure of the safety to function. If it is considered necessary for any reason to use any of these substances, the manufacturer of the elevator should be consulted before applying it.

1002.1d *Oil Buffers.*

The oil level should be checked at least once a month and the buffer kept full to the level indicated by the manufacturer.

The manufacturer of the buffer should be consulted as to the proper grade of oil to be used in the buffer (See Rules 201.4i and 201.4k).

Buffer plungers should be kept clean and shall not be coated or painted with a substance which will interfere with their operation.

1002.1e *Controller Contactors and Relays.*

Controller contactors and relays should be kept clean and free from dirt and should be lubricated where necessary as recommended by the manufacturer.

1002.1f *Car-Safety Mechanisms.*

All moving parts of car-safety mechanisms should be kept clean and free of rust and dirt and should be lubricated at frequent intervals. This is especially important where the equipment is exposed to water or corrosive vapors or excessively damp conditions, as corrosion or rusting of the parts may prevent operation of the safety.

Rule 1002.2 General Maintenance Requirements, Cleaning, Painting and Refinishing

1002.2a *Hoistways and Pits.*

Hoistways and pits should be kept clean and free of dirt and rubbish and shall not be used for storage purposes. Water should not be allowed to accumulate in pits.

1002.2b *Machine Rooms.*

Machine-room floors should be kept clean and free from oil or grease. Articles or materials not necessary for the maintenance or operation of the elevator shall not be stored therein. Flammable liquids having a flashpoint of less than one hundred and ten (110) degrees Fahrenheit shall not be kept in such rooms (See Rule 101.6).

1002.2c *Escalator Pit Pans.*

Escalator pit pans should be periodically cleaned of oil and refuse. The frequency of cleaning will depend on the service, but should be such as to reduce to a minimum the hazard resulting from accidental ignition.

1002.2d *Tops of Cars.*

The tops of cars should be kept clean and free from oil or grease and shall not be used for storing lubricants. Material not required for the operation of the elevator shall not be stored or carried on top of elevator cars (See Rule 204.1g).

1002.2e *Painting.*

Care should be used in the painting of the equipment to see that it does not interfere with the proper functioning thereof. This is especially important in the case of governors, car-safety parts and buffer parts; and these should be tested for proper operation after completion of painting (See Rule 206.3).

1002.2f *Refinishing of Elevator Cabs.*

Particular care should be used when refinishing elevator cabs in the hoistways.

The following precautions should be taken:

1 Only one (1) cab in a multiple hoistway should be refinished at a time.
2 The cab should be placed at the top terminal landing for refinishing.
3 The paint remover, paint, varnish and other chemicals used for refinishing elevator cabs should be applied by means other than spraying.
4 Blow torches should not be used for burning off old finishes or for other refinishing work inside of elevator cabs.
5 Before refinishing work is started, the following precautionary measures should be taken:
  a All electric supply and control lines to the cab, for lighting, fan, alarm bell, motor-generator set, operating switches or buttons, etc., should be disconnected from the supply circuit. The only lighting permitted in the cab during refinishing work should be by means of a portable light with a vapor-proof globe, without switch, connected to a convenience receptable located outside the hoistway. The light should be provided with a guard to prevent breakage.
  b A type of fire extinguisher, suitable for the material being used, should be placed near and outside the cab.
  c Vent at the top of the hoistway should be fully opened.
  d Top emergency exit in the cab should be fully opened.
  e The hoistway door at the floor where the work is being done should be kept fully open during the entire time of refinishing.
  f The car door should be kept open except when it is being refinished.

NOTE: A number of serious fires have occurred where the necessary precautions were not taken.

1002.2g *Fire Extinguishers.*

Fire extinguishers provided in electrical machinery and control spaces should be of a class suitable for "Class C" fires.

Rule 1002.3 Periodic Resocketing of Babbitted Rope Sockets or the Replacement or Moving of Other Types of Fastening of Car Hoisting Ropes on Winding Drum Type Machines.**

1002.3a** *Refastening Periods.*

The hoisting ropes of power elevators having winding drum driving machines with one-to-one (1:1) roping, if of the babbitted rope socket type, shall be resocketed or other type of fastenings replaced or moved on the rope to a point above the existing fastening, at the car ends at intervals no longer than:

1 Twelve (12) months for machines located over the hoistway.

2 Twenty-four (24) months for machines located below or at side of the hoistway.

EXCEPTION: Where auxiliary rope-fastening devices conforming to the requirements of Rule 212.10 are installed, refastening at the periods specified shall not be required provided that where such devices are installed all hoisting ropes shall be refastened on the failure or indication of failure of any rope fastening.

1002.3b** *Procedure.*

In resocketing babbitted rope sockets or replacing or changing the location of other types of fastenings, a sufficient length shall be cut from the end of the rope to remove damaged or fatigued portions. The fastenings shall conform to the requirements of Rule 212.9.

1002.3c* *Tags.*

A metal tag shall be securely attached to one of the wire rope fastenings after each resocketing or changing other types of fastenings and shall bear the following information:

1 The name of the person or firm who performed the resocketing or changing of other types of fastenings.
2 The date on which the rope was resocketed or other types of fastening changed.

The material and marking of the tags shall conform to the requirements of Rule 207.3c, except that the height of the letters and figures shall be not less than one-sixteenth (1/16) inch.

Rule 1002.4 Making Safety Devices Inoperative

No person shall at any time make any required safety device or electrical protective device inoperative, except where necessary during tests, inspections, and maintenance. Immediately upon completion of such tests, inspections, and maintenance, such devices shall be restored to their normal operating condition in conformity with the applicable requirements (See Rule 210.7).

Rule 1002.5 Maintenance of Hydraulic Elevators and Dumbwaiters

1002.5a *General.*

The maintenance of hydraulic elevators and dumbwaiters shall conform to the requirements of Section 1002.

1002.5b *Additional Requirements.*

1 *Pressure Tanks*
Pressure tanks shall be thoroughly cleaned internally at least every three (3) years and prior to the inspection and test required by Rule 1001.6c-1.
2 *Piston Rods*
Piston rods of roped hydraulic elevators and dumbwaiters shall be

thoroughly cleaned at least every three (3) years and prior to the inspection required by Rule 1001.6c-2.

3 *Pressure Tank Water Level*

The liquid level in pressure tanks should be maintained at about two-thirds (2/3) of the capacity of the tank.

4 *Valve and Cylinder Packings*

Valves and cylinders shall be kept properly packed and the packing glands periodically tightened to prevent loss of the fluid.

PART XI

ENGINEERING AND TYPE TESTS

SCOPE

**This part covers engineering and type tests required for certain elements of the assemblies covered by this Code.

SECTION 1100 — ENGINEERING TESTS OF CAR AND COUNTERWEIGHT OIL BUFFERS

Rule 1100.1 General

This section specifies the engineering tests of car and counterweight oil buffers as required by Rule 201.4g.

Rule 1100.2 Drawings, Data and Test Records

1100.2a *Drawings and Data to Be Submitted.*

Prior to the test, the manufacturer of each buffer to be tested shall submit to the laboratory:

1 Two complete sets of assembly and detail drawings of the buffer, showing:
  a The exact construction of the buffer.
  b All dimensions of each part.
  c All pertinent information as to materials and clearances.
  d The data as marked on the buffer marking plate as required by Rule 201.4k.

2 Complete data for the oil porting in relation to the effective buffer stroke.

1100.2b *Filing of Drawings and Test Records.*

The laboratory shall file the drawings showing the design of the buffer as certified together with the original test records, data, performance curves and the certification of the test, as a permanent record for future references.

1100.2c *Changes in Buffer Design Subsequent to Certification.*

Where any change is made in the design of the buffer by the manufacturer, after certification, revised drawings showing such change shall

be filed with the original or other qualified testing or certifying laboratory and the laboratory shall issue to the manufacturer a revised certificate. Changes in design which do not affect the buffer performance may be made without approval of the testing or certifying laboratory.

Changes in design which affect the buffer performance shall be made only when approved by the original or other qualified testing or certifying laboratory.

1100.2d *Examination of Test Records by Manufacturer.*

The laboratory shall make the original test records available for examination by the manufacturer submitting the buffer for test, on his request.

Rule 1100.3 Testing Equipment.

The testing equipment shall be of such design as to perform the tests specified herein and to determine that the buffer conforms to all the requirements of Section 201 for oil buffers and shall also conform to the following requirements:

- a *Calibration of Test Weight.* The required drop test load shall be accurate to within plus or minus one (1) percent.
- b *Guiding of Test Weight.* The test weight shall be so guided as to insure that when dropped onto the buffer its travel shall be substantially vertical.
- c *Test Instruments.* The instruments used to measure the test results shall conform to the following requirements:
  - 1 They shall be of the recording type.
  - 2 They shall provide data for the plotting of the buffer performance curves showing time intervals, travel of test weight, velocity of test weight and retardation of test weight during the buffer stroke which shall be accurate to within the following tolerances:
    - a The timing device shall record time in increments of not more than one-sixtieth (1/60) second during the entire buffer stroke.
    - b Time increments and total time shall be recorded with an error of less than plus or minus five-tenths (5/10) of one (1) percent.
    - c The position of the test weight at each time interval shall be recorded with an error of less than plus or minus one-tenth (1/10) of one (1) percent.
    - d Time and travel, velocity and retardation shall be determined by means of a device which will provide the accuracy specified.

Rule 1100.4 Installation of Buffer, and Preparations for Tests

1100.4a *Foundation and Location of Buffer.*

Spring return buffers shall be placed on a foundation designed to

withstand without appreciable deformation the forces resulting from the buffer compression on the drop tests. The buffer shall be installed in a vertical position and located centrally with relation to the drop-test weight.

1100.4b *Securing of Buffer.*

The buffer shall be secured by bolts in accordance with the manufacturer's drawings or by equivalent means to:

1 The foundation, for buffers of the spring-return type.
2 The underside of the center of the test drop-weight for buffers of the gravity-return type.

The center line of the buffer, when secured in place, shall be vertical to within one one-hundredth (1/100) inch in the stroke of the buffer.

1100.4c *Special Adjustments.*

Special features or adjustments shall not be provided which can be construed as being furnished or made solely for the purpose of meeting the specified test requirements.

1100.4d *Filling Buffer with Oil.*

The buffer after being installed, shall be filled with oil to a level at or between the manufacturer's gage line or lines. The oil shall conform to the requirements of Rule 201.4i and specified on the buffer marking plate.

After filling with oil, the following procedure shall be followed to insure that a constant oil level has been established:

1 The buffer shall be fully compressed at slow speed, and shall then be allowed to return to its fully extended position and remain there for at least ten (10) minutes. The oil level shall then be checked.
2 If the oil level as previously determined has changed, due to the elimination of entrapped air or due to the retention of air under pressure within the buffer, the change in level shall be noted and the procedure repeated until a constant oil level is obtained when the buffer is in its extended position.
3 If the oil level tends to remain above the level to which it was filled, the air vents, if provided, should be checked for obstructions.
4 When a constant oil level has been established, the level shall be adjusted to the manufacturer's lowest gage line and the exact level noted and recorded before making the drop tests hereinafter specified.

Rule 1100.5 Buffer Tests

Each oil buffer with oil portings as submitted shall be subjected to tests for retardation, strength, oil leakage, plunger return and lateral move-

ment of the plunger, as hereinafter specified.

1100.5a *Retardation Tests.*

The following drop tests shall be made for each buffer porting specified in Rule 201.4g-1, from a height such that the striking velocity of the falling weight will be equal to one hundred and fifteen (115) percent of the rated car speed for which the buffer is designed:

1 Three (3) drop tests, with a total test weight equal to the manufacturer's rated maximum load for which the porting is designed (See Rule 201.4g-1a).
2 One (1) drop test with a total test weight equal to the manufacturer's rated minimum load for which the porting is designed (See Rule 201.4g-1b).

Following each drop test, the buffer shall be held in its fully compressed position for a period of five (5) minutes; and shall then be allowed to return freely to its fully extended position and stand for thirty (30) minutes to permit return of the oil to the reservoir and to permit escape of any air entrained in the oil.

On each of these tests the average retardation of the test weight, over the stroke of the buffer, shall not exceed thirty-two and two tenths (32.2) feet per second per second; and any retardation peak having a duration of more than one twenty-fifth (1/25) of a second shall not exceed eighty and one-half (80½) feet per second per second.

If the laboratory tests show that the manufacturer's rated maximum and minimum loads for a given porting are either high or low, the lavoratory may elect to determine the load values which will develop retardations within the specified limits, without consulting the manufacturer, provided these values are within ten (10) percent of the manufacturer's rated loads.

If the permissable load values determined by the laboratory are more than ten (10) percent above or below the manufacturer's corresponding maximum or minimum load, the laboratory shall consult with the manufacturer before proceeding with additional tests.

No part of the buffer shall show any permanent deformation or injury on completion of the drop tests.

1100.5b *Strength Tests.*

Two drop tests shall be made as follows:

1 One (1) drop test shall be made with the porting as specified in Rule 201.4g-1a, with a total test weight equal to one hundred and twenty (120) percent of the manufacturer's rated maximum load, from a height such that the maximum velocity attained by the falling weight during the buffer compression shall be equal to one hundred and twenty-five (125) percent of the rated car speed for which the buffer

is rated. In this test, the retardation shall be noted and may exceed the values specified in Rule 1100.5a.

Immediately following this test, the buffer shall be examined externally for visible deformation or injury. If no damage is apparent, the buffer shall then be fully compressed at low speed and then released to determine if it will return freely to its extended position.

2 After the buffer has been examined externally and has returned freely to its extended position, a second drop test shall be made from the same height and with the same load as specified in Rule 1100.5a-1. During this test the retardation shall not exceed the corresponding retardation developed in the test specified in Rule 1100.5a-1 by more than five (5) percent.

If for a given stroke of buffer having more than one (1) porting, the construction of the buffer varies for the different portings, then a strength test similar to that specified in Subdivision 1 shall also be made for the porting having the range of minimum loads for which the porting is designed as specified in Rule 201.4g-1b.

Following each drop test, the buffer shall be held in its fully compressed position for a period of five (5) minutes; and shall then be allowed to freely return to its fully extended position, and stand for thirty (30) minutes, to permit return of the oil to the reservoir and to permit the escape of any air entrained in the oil.

1100.5c *Oil-Leakage Tests.*

Tests for oil leakage shall be made concurrently with the retardation tests specified in Rule 1100.5a, and the drop test specified in Rule 1100.5b-2, to determine the loss of oil during these tests. The oil level shall be noted after the buffer has returned to its fully extended position following each drop test, and after the time interval specified in Rule 1100.5a.

The drop in oil level, as indicated by these measurements, shall show no loss of oil exceeding one-sixteenth (1/16) inch in level for each foot of buffer stroke, but in no case shall the loss be such as to lower the oil level below the bottom of the plunger or below the highest metering orifice, whichever is higher.

Where the volume of oil above the porting is small, when the buffer is filled to its normal working level, the laboratory may make additional tests for oil leakage.

1100.5d *Plunger-Return Test.*

On the drop tests specified in Rules 1100.5a and 1100.5b, the time re-

quired for the buffer plunger to return to its fully extended position, measured from the instant the test weight is raised clear of the buffer until the plunger has returned to its fully extended position, shall be noted. This time shall be not more than ninety (90) seconds.

Should the plunger fail to return to its fully extended position or should the time required for it to return to its fully extended position exceed the time specified, the manufacturer shall either submit a duplicate buffer or install a new pressure cylinder and piston, following which the plunger-return test shall be repeated. Should the buffer again fail to meet the plunger-return test requirements, it shall be rejected.

Buffers of the spring-return type shall be tested for plunger return with a fifty (50) pound test-weight resting on top of the plunger during the test. The plunger shall be depressed two (2) inches and, when released, the plunger while supporting the test-weight shall return to its fully extended position within thirty (30) seconds.

1100.5e *Tests for Lateral Movement.*

The following tests shall be made for lateral movement:

1 *Spring-Return Type Buffers.* The lateral movement at the top of the fully extended plunger shall be accurately measured, the upper end of the plunger being moved by hand from its extreme right to its extreme left position. One-half (½) of the total movement measured shall be considered as being the true lateral movement at the top of the plunger and shall not exceed one-sixteenth (1/16) inch per foot of buffer stroke.

2 *Gravity-Return Type Buffers.* A similar test for lateral movement shall be made, the measurement being taken at the lower end of the buffer cylinder when the buffer plunger is fully extended and braced to prevent lateral movement. One-half (½) of the total movement measured shall not exceed one-sixteenth (1/16) inch per foot of buffer stroke.

1100.5f *Certification.*

When the buffer has been subjected to all of the specified tests and all test records and data indicate that it conforms to the requirements of Section 201, and to the requirements of this section, the laboratory shall issue to the manufacturer a test report and a certificate stating that the buffer of the particular stroke, and having the portings tested, has met the requirements of Section 201, and of this section, for the maximum and minimum loads as stated in the certificate.

SECTION 1101 — ENGINEERING TESTS OF HOISTWAY-DOOR INTERLOCKS, HOISTWAY-DOOR COMBINATION MECHANICAL LOCKS AND ELECTRIC CONTACTS, AND HOISTWAY-DOOR AND CAR-DOOR OR GATE ELECTRIC CONTACTS

Rule 1101.1 General

This section specifies the engineering tests of hoistway-door interlocks, combination mechanical locks and electric contacts, and hoistway-door and car-door or gate electric contacts, to be made by or under the supervision of the testing laboratory as required by Rule 111.6a.

Rule 1101.2 Laboratory Examination Before Test

Prior to testing, the testing laboratory shall carefully examine each device submitted to ascertain that it conforms to the applicable requirements.

Only devices which conform to the requirements of Section 111, shall be tested.

Rule 1101.3 General Requirements

1101.3a *Connections for and Test of, Electrical Parts.*

During the tests specified in subdivision a, c, and d, of Rule 1101.4 the devices shall have their electrical parts connected in a non-inductive electrical circuit having a constant resistance and in which a current of one-half (½) ampere, from a source of one hundred and fifteen (115) volts direct current, is flowing. A separate device shall be used for each of these tests and the electric circuit shall be closed, but shall not be broken at the contact within the device on each cycle of operation during the tests.

1101.3b *Retesting of Electric Contacts Previously Tested.*

If the electric contact of a device submitted for test has already been tested as part of another device, and has successfully met the test requirements, the electrical tests of the contact need not be repeated.

1101.3c *Tests of Retiring Cams or Equivalent Devices.*

Tests of retiring cams or equivalent devices used to operate interlocks shall not be required.

1101.3d *Tests of Hoistway-Door Combination Mechanical Locks and Electric Contacts.*

The testing equipment shall actuate the mechanical-locking members of hoistway-door combination mechanical locks and electric contacts to unlock at each cycle of operation during the tests specified in subdivisions a, c, and d of Rule 1101.4.

Rule 1101.4 Required Tests and Test Procedure

Each device submitted shall be subjected to and shall successfully pass the following tests:

a *Endurance Test.* The device, with initial lubrication and adjustment only, shall complete one hundred thousand (100,000) cycles of operation without failure of any kind, without excessive wearing or loosening of parts, or without undue burning or pitting of the contacts (See Rule 1101.3a).

b *Current Interruption Test.* After completion of test a, the device used therein shall satisfactorily complete one thousand (1000) cycles of making and breaking a circuit at the contact within the device, with a rate of movement not less than in normal service. During this test, the electrical parts shall be connected in a non-inductive electric circuit having a constant resistance and in which a current of two amperes, from a source of two hundred and thirty (230) volts direct current, is flowing.

c *Test in Moist Atmosphere.* The device shall be given a wearing-in run of ten thousand (10,000) cycles of operation fully lubricated.

The device, except self-lubricating bearings and bearings of a type not requiring frequent replenishment of the lubricant, shall then be taken apart and freed of lubricant by washing in carbon tetrachloride or other nonflammable liquid having similar cleansing characteristics.

After re-assembling the device shall be subjected, continuously in an unventilated enclosure, to an atmosphere saturated with a three and one-half (3.5) percent solution of sodium chloride for seventy-two (72) consecutive hours. During this period it shall be operated for only ten (10) consecutive cycles at the end of each of the first two twenty-four (24) hour periods and shall be allowed to stand exposed to the air for twenty-four (24) hours, and shall not fail in a manner that creates an unsafe condition.

The device shall again be lubricated and shall, without adjustment and without further attention, complete fifteen thousand (15,000) cycles of operation without failure of any kind.

d *Test Without Lubricant.* The fully lubricated device shall be given a wearing-in run of ten thousand (10,000) cycles of operation.

The device, except self-lubricating bearings and bearings of a type not requiring frequent replenishment of lubricant, shall then be taken apart and freed of lubricant by washing in carbon tetrachloride or other nonflammable liquid having similar cleansing characteristics.

After reassembling, the device shall, without other than the usual initial adjustment (i.e., without adjustment especially made to meet

the conditions of this particular test) and without further attention, complete twenty-five thousand (25,000) cycles of operation without failure of any kind, without excessive wearing or loosening of parts or without undue burning or pitting of contacts.

e *Misalignment Tests.*

1 *All Types of Doors.* The device shall operate effectively when the car cam or other equivalent operating device used in making the test has been displaced horizontally from its normal position (the position in which it was when the device was installed) successively, as follows:

a In a direction perpendicular to the plane of the door opening:
1 Backward one-quarter (¼) inch.
2 Forward one-quarter (¼) inch.

b In a direction parallel to the plane of the door opening:
1 To the right one-quarter (¼) inch.
2 To the left one-quarter (¼) inch.

2 *Horizontally Sliding Doors.* The device shall operate effectively:

a When the bottom of the door has been displaced horizontally from its normal position in a direction perpendicular to the plane of the door opening:
1 Backward one-quarter (¼) inch.
2 Forward one-quarter (¼) inch.

b When the top of the door has been displaced horizontally from its normal position in a direction perpendicular to the plane of the door opening:
1 Backward one-eighth (⅛) inch.
2 Forward one-eighth (⅛) inch.

3 *Swinging Doors.* The device shall operate effectively when the strike edge of the door has been displaced:

a Perpendicular to the plane of the door opening:
1 Forward one-eighth (⅛) inch.
2 Backward one-eighth (⅛) inch.

b Parallel to the plane of the door opening:
1 One-eighth (⅛) inch to the right.
2 One-eighth (⅛) incn to the left.
3 One-eighth (⅛) inch up.
4 One-eighth (⅛) inch down.

4 *Vertically Sliding Doors.* The device shall operate effectively when the door has been displaced:

a Perpendicular to the plane of the door opening:
1 Forward one-eighth (⅛) inch.
2 Backward one-eighth (⅛) inch.

b Parallel to the plane of the door opening:
1 One-eighth (1/8) inch to the right.
2 One-eighth (1/8) inch to the left.

f *Insulation Test.* The insulation of the electrical parts shall withstand a test with an effective voltage of twice the rated voltage plus one thousand (1000) volts, sixty (60) cycle current, applied for one (1) minute.

g *Force and Movement Test.* When testing devices of a type which are released by a retiring cam, measurements shall be made of the force required to release the device and of the movement of the element engaged by the cam, with the device mounted in its normal position as specified by the manufacturer, before and after the test specified in Rule 1101.4-a.

The force and movement recorded in each test shall be respectively:

1 The maximum force, measured in a horizontal plane, which must be applied to that member of the device which is directly actuated by the cam to release the door-locking member of the device from locking engagement.

2 The distance, projected on a horizontal plane, which the member of the device directly actuated by the cam travels from its position when the lock is fully engaged to its position when the locking member is released from engagement.

The force and movement markings required by Rules 111.6d-4 and 111.6d-5 shall be not less than the average of these recorded values.

SECTION 1102* — ENTRANCE FIRE TESTS

Rule 1102.1* Test of Entrances, Horizontal Slide and Swing Types

Test of elevator entrance assemblies, horizontal slide type and swing type, shall be conducted in accordance with ANSI A2.2-1968 (ASTM E 152-66) with the following specific paragraphs modified to read as follows:

5(a) The construction and size of the test entrance assembly, shall be representative of that for which classification or rating is desired. The materials and construction of the door and frame, and the details of the installation, hardware, trim, finish and clearance of lap shall be recorded. All elements of the assembly shall conform to all other requirements of this Code.

NOTE: It is not required that interlocks and closers be mounted on the test assembly.

5(b) A sill shall be provided as part of the opening to be protected except where such sill interferes with the operation of the door. The sill shall be of noncombustible material.

6(a) Swing type entrance assemblies shall be mounted in a wall with the panel on the side away from the furnace chamber and with the door opening into the furnace chamber.

6(b) Horizontal slide type entrance assemblies shall be mounted on the side of the furnace chamber wall away from the furnace chamber.

6(c) Clearance for swing type entrance assemblies shall be as follows: with a minus one-sixteenth (1/16) inch tolerance: one-eighth (⅛) inch along the hinge and closing jambs, and three-eighths (⅜) inch at the bottom edge.

6(d) Clearances for horizontal slide type entrances shall be three-eights (⅜) inch with minus one-eighth (⅛) inch tolerance between the wall or jamb and the face of the panel(s) and from the bottom of the panel(s) to the sill.

Panels shall overlap the wall or jamb and header and adjacent overlapping panel(s) by three-quarters (¾) inch with a minus tolerance of one-eighth (⅛) inch.

11(d) (1) The warpage of panels of horizontal slide entrance assemblies during the fire test and as a result of the hose stream test, shall develop no openings greater than two and seven-eighths (2⅞) inches between the panel(s) and the entrance frame or wall or between the panels of multi-speed entrances.

(2) The meeting edges of center opening panels shall not move apart more than one and one-quarter (1¼) inches as measured in any horizontal plane.

11(f) The test assembly shall have withstood the fire endurance test and hose stream test, without developing openings, anywhere through the assembly.

EXCEPTION: Specified clearances, permitted openings which develop as a result of the warpage, and small portions of glass dislodged by the hose stream shall not be cause for rejection.

Rule 1102.2* Test of Entrances, Vertical Slide Type

Test of elevator and dumbwaiter entrance assemblies, vertical slide type shall be conducted in accordance with ANSI A2.2-1968 (ASTM E 152-66).

SECTION 1103 — TYPE TESTS OF ESCALATORS

Rule 1103.1 Type Tests of Escalators

Each type and size of escalator shall be tested for the rated load that it is designed to carry. Such tests may be made, at the option of the manufacturer, in his plant or in the field on the first escalator of that type and size installed in a building.

Where a type and size of escalator has previously been tested and approved in one jurisdiction, certified copies of such test may be accepted in lieu of an actual test at the option of the enforcing authority.

If the rise for a given type and width to be installed is more than five (5) feet higher than the rise for which that type and width has been tested, a new type test shall be made for the higher rise.

PART XII

ALTERATIONS, REPAIRS AND REPLACEMENTS

SCOPE

**This part applies to alterations, repairs and replacement of parts on electric and hydraulic elevators.

SECTION 1200 — ELECTRIC ELEVATORS

Rule 1200.1 General Requirements

1200.1a *Major Alterations.*

The following alterations shall be considered major alterations:

1 Increase in rated load or speed. (Rule 1200.2a)
2 Increase in dead weight of car. (Rule 1200.2b)
3 Increase or decrease in travel. (Rule 1200.2c)
4 Change in type of operation or control. (Rule 1200.2d)
5 Change in size or number of hoisting or counterweight ropes. (Rule 1200.2e)
6 Change in size or type of guide rails. (Rule 1200.2f)
7 Replacement of or change in type of car or counterweight safety. (Rule 1200.2g)
8 Permissive use of freight elevators to transport employees. (Rule 1200.2h)
9 Change in classification from freight to passenger service. (Rule 1200.2i)
10 Change in power supply. (Rule 1200.2j)
11 Replacement of an existing driving machine by a new driving machine. (Rule 1200.2k)
12 Replacement of an existing controller by a new controller. (Rule 1200.2m)
13 Replacement of an existing driving-machine brake by a new brake. (Rule 1200.2n)
14 Replacement of hoistway doors. (Rule 1200.2p)
15 Addition of hoistway door locking devices or car door or gate electric contacts. (Rule 1200.2q)

16 Addition of hoistway access switches. (Rule 1200.2r)
17 Addition of top-of-car operating devices. (Rule 1200.2s)
18 Addition of hoistway-door and/or car-door or gate operating devices. (Rule 1200.2t)
19 Addition of rope equalizers. (Rule 1200.2u)
20 Addition of auxiliary rope-fastening devices. (Rule 1200.2v)
21 Addition of car-leveling or truck-zoning devices. (Rule 1200.2w)
22 Addition of roller guide shoes. (Rule 1200.2x)

1200.1b *Minor Alterations.*

Any alteration not listed in Rule 1200.1a shall be considered a minor alteration. Any part of the installation directly affected as to safety, due to such alteration, shall conform to the requirements of this Code for such part.

1200.1c *Installation of Partitions in Elevator Cars to Reduce Inside Net Platform Areas.*

Where partitions are installed in elevator cars for the purpose of reducing the inside net platform areas for passenger use, they shall conform to the requirements of Rule 207.1a.

Rule 1200.2 Requirements for Major Alterations

Where any major alteration listed in Rule 1200.1a is made it shall conform to the applicable requirement hereinafter specified.

1200.2a *Increase in Rated Load or Speed.*

Where the alteration involves an increase in the rated load or rated speed the following requirements of Part I and Part II shall be conformed to:

1 Increase in Rated Speed.
   a *Bottom Runby and Top Clearance.* The bottom runbys and the top clearances for cars and counterweights shall conform to Rules 107.1b through 107.1j inclusive.
   b *Buffers.* The car and counterweight buffers shall conform to the requirements of Section 201 and shall be tested as specified in Rules 1000.1 and 1000.3.

   EXCEPTION: Existing buffers, where retained, are not required to conform to Rule 201.4e-2 and to Rule 201.4g.

   c *Car Doors and Gates.* Car doors or gates shall be provided at all car entrances. Where new car doors or gates are installed they shall conform to the applicable requirements of Section 204. Car doors and gates shall be provided with car door or gate electric contacts conforming to the applicable requirements of Section 111.
   d *Car and Counterweight Safety and Governor.* The car safety and

the counterweight safety where provided, and the governor shall conform to the requirements of Sections 205 and 206 respectively and shall be tested as specified in Rules 1000.1 and 1000.2.

EXCEPTIONS:

(1) The switch operated by the car safety, required by Rules 205.7 and 206.4a, may be omitted if a governor overspeed switch is provided.

(2) The governor overspeed switch required by Rule 206.4 may be omitted with Class A safeties where a switch operated by the car safety conforming to Rules 205.7 and 206.4a is provided.

(3) The pitch diameter of speed governor sheaves and governor tension sheaves is not required to conform to Rule 206.7.

(4) Where gradual wedge clamp and drum operated flexible guide clamp safeties are re-used, the maximum stopping distances shall conform to Rule 1001.4-b3.

e *Car Capacity and Loading.* The car capacity and loading shall conform to Section 207.

f *Driving Machine and Sheaves.* The driving machine and sheaves shall conform to Section 208.

g *Terminal Stopping Devices.* The terminal stopping devices shall conform to Section 209.

h *Operating Devices and Control Equipment.* The operating devices and control equipment shall conform to the requirements of Section 210.

EXCEPTIONS: Conformity to the following rules shall not be required:

(1) 210.1d.

(2) 210.2-e Subdivisions 1, 2 and 3.

(3) 210.2 Subdivisions g, h, n, q, r and s (See also exceptions 1 and 2 to Subdivision d of this Rule 1200.2a-1).

(4) 210.3 through 210.6 inclusive.

i *Hoisting Ropes and Rope Connections.* The car and counterweight hoisting ropes and rope connections shall conform to the requirements of Section 212.

EXCEPTION: Elevators whose rated speed is increased not more than fifteen (15) percent due to the replacement of a direct-current motor by an alternating-current motor.

2 Increase in Rated Load.

a *Machinery and Sheave Beams, Supports and Foundations.* The machine and sheave beams, supports and foundations shall conform to the requirements of Section 105.

b *Guide Rails, Supports and Fastenings.* The car and counterweight guide rails, guide rail supports and fastenings shall conform to the requirements of Section 200.

c *Buffers.* The car and counterweight buffers shall conform to Section 201 and shall be tested as specified in Rules 1000.1 and 1000.3.

EXCEPTION: Existing buffers where retained are not required to conform to the requirements of Rule 201.4e-2 and to Rule 201.4g.

d *Counterweights.* The counterweight shall conform to the requirements of Section 202.

EXCEPTION: Existing rod-type counterweights may be retained provided that the counterweight rods shall have a factor of safety of not less than five (5) with the elevator at rest and the counterweight at the top of its travel, and provided that existing rods shall not be lengthened by welding.

e *Car Frames and Platforms.* Car frames and platforms shall conform to the requirements of Section 203.

f *Car Doors and Gates.* Car doors and gates shall conform to the requirements specified in Subdivision 1(c) of this Rule.

g *Car and Counterweight Safety and Governor.* The car safety, and the counterweight safety where provided, and the governor shall conform to the requirements specified in subdivision 1(d) of this rule and shall be tested as specified in Rules 1000.1 and 1000.2.

h *Capacity and Loading.* The capacity and loading shall conform to the requirements of Section 207.

i *Driving Machine and Sheaves.* The driving machine and sheaves shall conform to the requirements of Section 208.

EXCEPTION: Conformity to Rule 208.1 shall not be required.

j *Hoisting and Counterweight Ropes and Rope Connections.* The car and counterweight suspension ropes and their connections shall conform to the requirements of Section 212.

1200.2b *Increase in Dead Weight of Car.*

Where an alteration results in an increase in the dead weight of the car of more than five (5) percent, the following parts of the equipment shall conform to the strength and capacity requirements relating thereto in Parts I and II:

1 Machine beams, sheave beams, and suspension-rope hitch-plate supporting beams, supports and foundations.

2 Car and counterweight guide rails.

3 Car and counterweight buffers.

4 Car frames, platforms, car safeties, counterweight safeties if any, speed governors, hoisting and counterweight ropes and rope connections.

5 Car safeties, counterweight safeties if any, and car and counterweight oil buffers shall be tested as specified in Rules 1000.1, 1000.2 and 1000.3.

EXCEPTION: Where gradual wedge clamp and drum operated flexible guide clamp safeties are reused, the maximum stopping distances shall conform to the requirements of Rule 1001.4-b3.

6 Driving machines and sheaves.

1200.2c *Increase or Decrease in Travel and Change in Location of the Driving Machine.*

Where the travel is increased or decreased or where the location of the driving machine is changed the following requirements shall be conformed to:

1 Where an alteration involves an increase in the travel of not more than fifteen (15) feet, or any decrease in travel, without any change in the location of the driving machine, the following requirements shall be conformed to:

a The terminal stopping devices shall be relocated to conform to the requirements of Section 209.

b Where the travel is increased, an existing winding-drum machine may be retained provided the existing drum is of sufficient dimensions to serve the increased travel with not less than one full turn of wire rope remaining on the winding drum when the car or counterweight has reached its extreme limits of overtravel.

c The car and counterweight overhead clearances and runbys shall conform to Section 107.

EXCEPTION: Where the increase in travel is at the lower end of the hoistway, the existing overhead car and counterweight clearances are not required to conform to the requirements of Section 107.

2 Where the alteration involves an increase in the car travel of more than fifteen (15) feet or where the location of the driving machine is changed, the entire installation shall conform to the requirements of Parts I and II. Car safeties, counterweight safeties if any, governors, and car and counterweight oil buffers shall be tested as specified in Rules 1000.1, 1000.2 and 1000.3.

EXCEPTIONS:

(1) Where the increase in travel is at the upper end of the hoistway, the existing bottom car clearance and car and counterweight runby are not required to conform to the requirements of Section 107.

(2) Where gradual wedge clamp and drum operated flexible guide clamp safeties are reused, the maximum stopping distance shall conform to the requirements of Rule 1001.4-b3.

1200.2d *Change in Type of Operation and/or Control.*

Where the alteration consists in a change in the existing type of operation to any other type of operation the following requirements of Part I and Part II shall be conformed to:

1 *Change in Type of Operation.*

a Protection of Hoistway Landing Openings. The protection of the hoistway landing openings shall conform to the requirements of Rules 110.1a and 110.1c through 110.16 inclusive.

b *Car Enclosures and Car Doors or Gates.* Car enclosures and car doors or gates shall conform to Section 204.

EXCEPTIONS: Where existing car enclosures and/or car doors or gates are retained, conformity to the following rules shall not be required:

(1) 204.1c.
(2) 204.1e.
(3) 204.1f, h and i.
(4) 204.2a.
(5) 204.2c through e inclusive.
(6) 204.3.
(7) 204.4c.
(8) 204.4f
(9) 204.4g
(10) 204.7

c *Capacity and Loading.* The capacity and loading shall conform to the requirements of Section 207.

d *Terminal Stopping Devices.* The terminal stopping devices shall conform to the requirements of Section 209.

e *Operating Devices and Control Equipment.* The operating devices and control equipment shall conform to the requirements of Section 210.

EXCEPTIONS: Conformity to the following rules shall not be required:

(1) 210.1d, where the change is to continuous-pressure operation.
(2) 210.2-g.
(3) 210.2-i where the requirements of Rule 210.2-j are conformed to.
(4) 210.2-j where a type A safety is used and the requirements of Rule 210.2-i are conformed to.
(5) 210.2-q where the existing car enclosure is not provided with side emergency exits.

f *Emergency Signal Devices.* Emergency signal devices shall be provided conforming to the requirements of Section 211.

g Where an increase is made in the capacity and loading (subitem c), the car safety, counterweight safety if any, governor, and car and counterweight oil buffers shall be tested as specified in Rules 1000.1, 1000.2 and 1000.3.

EXCEPTION: Where the change in operation is to car switch operation, conformity to the following rules is not required:

(1) Subdivisions 1(a), 1(b), and 1(c) of Rule 1200.2d-1.
(2) 210.1d.
(3) 210.2-n and 210.2-o.

2 *Change in Type of Control.*

a *Terminal Stopping Devices.* The terminal stopping devices shall conform to the requirements of Section 209.

b *Operating Devices and Control Equipment.* The operating devices and control equipment shall conform to the requirements of Section 210.

EXCEPTIONS: Conformity to the following Rules shall not be required:

(1) 210.1d.

(2) 210.2-g.

(3) 210.2-i where the requirements of Rule 210.2-j are conformed to.

(4) 210.2-j where a type A safety is used and the requirements of Rule 210.2-i are conformed to.

(5) 210.2-n and 210.2-o.

(6) 210.2-q where the existing car enclosure is not provided with side emergency exits.

1200.2e *Change in Size, or Number of Hoisting or Counterweight Ropes.*

Where the size, or number of hoisting or counterweight ropes is changed, the new ropes and their fastenings shall conform to the requirements of Section 212 for such equipment.

1200.2f *Change in Size or Type of Guide Rails.*

Where the size or type of the guide rails is changed, the new guide rails together with their fastenings and supports, and the car safety, and the counterweight safety if any, shall conform to the requirements of Part II for such equipment. The safeties shall be tested as specified in Rules 1000.1 and 1000.2.

1200.2g *Replacement of or Change in Type of Car or Counterweight Safety.*

Where the car or counterweight safety is replaced or changed in type it shall meet the requirements of Section 205 for such equipment and shall be tested as specified in Rules 1000.1 and 1000.2.

1200.2h *Permissive Use of Freight Elevators to Transport Employees.*

The enforcing authority may, upon application and after tests as specified in Rule 1000.1 of this Code, permit the use of existing freight elevators, which are so located as to be not available to or used by the general public, for the transportation of employees, in addition to the regular operator and the persons necessary for loading and unloading, subject to the following:

1 The hoistway doors and hoistway-door locking devices shall conform to the requirements of Sections 110 and 111.

2 The machinery and equipment shall conform to the requirements of Part II for freight elevators (See Rule 1200.1c and Rule 207.4 for additional requirements). If rated load increases, the car safety and counterweight safety if any, and the car and counterweight oil buffers shall be tested as specified in Rules 1000.1, 1000.2 and 1000.3.

EXCEPTIONS:

(1) Freight-car enclosures made of wood may be retained provided the enclosures conform in all other respects to the requirements of Section 204.

(2) Where gradual and drum operated flexible guide clamp safeties are reused, the maximum sliding distances shall conform to the requirements of Rule 1001.4-b3.

1200.2i *Changes in Classification From Freight to Passenger Service.*

Where the alteration consists of a change in classification of a freight elevator to passenger elevator service, the installation shall conform to the following requirements for passenger elevators:

1 Sections 110 to 112 inclusive.
2 Sections 201, 203 to 210 inclusive and Section 212.
3 If rated load increases, the car safety and counterweight safety if any, and the car and counterweight oil buffers shall be tested as specified in Rules 1000.1, 1000.2 and 1000.3.

EXCEPTION: Where gradual wedge clamp and drum operated flexible guide clamp safeties are reused, the maximum stopping distances shall conform to the requirements of Rule 1001.4-b3.

1200.2j *Change in Power Supply.*

Where the alteration consists of a change in the power supply involving:

1 Change in voltage, frequency or number of phases, or
2 Change from direct to alternating current or vice versa, or
3 Change to a combination of direct and alternating current, only such electrical equipment or parts thereof as are adjusted or altered to operate safely and properly shall be retained.

Where the change is from direct to alternating current, existing electric brakes if inadequate shall be replaced with electrically released brakes of sufficient capacity to meet the operating and test requirements of this Code.

Where the elevator is not equipped with an electrically released brake, it shall be so provided and shall conform to the requirements of Rules 208.8 and 210.8.

In changing from direct to alternating current power supply, controllers, motors and terminal stopping devices shall conform to the requirements of Part II.

Where the change in power supply involves the use of rectifiers, the installation shall conform to the requirements of Rule 210.10.

1220.2k *Replacement of an Existing Driving Machine by a New Driving Machine.*

Where the alteration involves only the replacement of an existing driving machine by a new driving machine, the new machine shall conform to the requirements of Section 208.

1220.2m *Replacement of an Existing Controller by a New Controller.*

Where the alteration consists of the replacement of an existing controller by a new controller, without any change in the type of operation or control, the new controller shall conform to the requirements of Rules 210.8, 210.9 and 210.10.

1200.2n *Replacement of an Existing Driving-Machine Brake by a New Brake.*

Where the alteration involves the replacement of an existing driving-machine brake by a new driving-machine brake, the new brake shall conform to the requirements of Rules 208.8 and 210.8.

1200.2p *Replacement of Hoistway Doors.*

Where all of the existing hoistway doors are replaced by new doors or where hoistway gates are replaced with new hoistway doors, the new hoistway doors and their interlocks and/or electric contacts and mechanical locks shall conform to the requirements of Sections 110 and 111 respectively.

1200.2q *Addition of Hoistway-Door Locking Devices, or Car Door or Gate Electric Contacts.*

Where the alteration consists of the addition of hoistway-door interlocks, hoistway-door combination mechanical locks and electric contacts or of car-door or gate electric contacts, the driving machine shall be equipped with an electrically released brake and the parts added shall conform to the applicable requirements of Rules 111.1 to 111.11 inclusive.

1200.2r *Addition of Hoistway Access Switches.*

Where hoistway access switches are installed, they shall conform to the requirements of Rule 111.9.

1200.2s *Addition of Top-of-Car Operating Devices.*

Where top-of-car operating devices are installed, they shall conform to the requirements of Rule 210.1d.

1200.2t *Addition of Hoistway and/or Car-Door or Gate Operating Devices.*

Where hoistway and/or car-door or gate power operating devices are installed, they shall conform to the requirements of Section 112, and in addition the hoistway-door hangers, door guides and guide shoes, interlocks and/or electric contacts and mechanical locks shall conform to the requirements of Sections 110 and 111.

1200.2u *Addition of Rope Equalizers.*

Where rope equalizers are installed, they shall conform to the requirements of Rule 212.5.

1200.2v *Addition of Auxiliary Rope-Fastening Devices.*

Where auxiliary rope-fastening devices are installed, they shall conform to the requirements of Rule 212.10.

1200.2w *Addition of Car-Leveling or Truck-Zoning Devices.*

Where the alteration consists of the addition of a car-leveling device or a truck-zoning device, such device shall conform to the requirements of Rule 210.1e.

1200.2x *Addition of Roller Guide Shoes.*

Where roller or similar-type guide shoes are installed, which allow a definite limited movement of the car or counterweight with respect to the guide rails, the clearance between the car and/or counterweight safety jaws and the rails shall be such that the safety jaws cannot touch the rails when the car frame is pressed against the rail faces with sufficient force to take up all movement of the roller guides.

NOTE: This may require extensive alterations to the existing car or counterweight safety device.

Rule 1200.3 Repairs and Replacements of Damaged, Broken or Worn Parts

Ordinary repairs and replacements of damaged, broken or worn parts, necessary for normal maintenance, may be made with parts of equivalent material, strength and design subject to the requirements of Rule 1200.2, except that the replacement of wood overhead beams or wood guide posts or wood car frames shall be made with those made of metal meeting the requirements of this code. Broken or damaged parts subject to tension, torsion or bending, or parts on which the support of the elevator car depends, shall not be repaired by welding.

NOTE: It is not the intent to prohibit the replacement of damaged or worn wood guide rails, but only to prohibit the replacement of the wood guide posts which support the wood guide rails.

SECTION 1201 — HYDRAULIC ELEVATORS

Rule 1201.1 General Requirements

1201.1a *Major Alterations.*

Any alteration listed in Rule 1200.1a shall, when made on a hydraulic elevator, be considered a major alteration.

In addition, the following alterations shall be considered major alterations and shall conform to the applicable requirements of Part III:

1 Replacement of an existing control valve with a valve of a different type.
2 Replacement of existing relief and check valves.
3 Replacement of existing supply piping and fittings.

4 Replacement of existing tanks.
5 Replacement of a cylinder and/or plunger with a cylinder or plunger of different material, size or design.
6 Increase in working pressure.

1201.1b *Minor Alterations.*

Any alteration not considered by Rule 1201.1a to be a major alteration shall be considered a minor alteration. Any parts of the installation directly affected as to safety, due to such alteration, shall conform to the requirements of this Code for such part.

1201.1c *Installation of Partitions in Elevator Cars to Reduce Inside Net Platform Area.*

Where partitions are installed in elevator cars for the purpose of reducing the inside net platform areas for passenger use, they shall conform to the requirements of Rule 207.1a.

Rule 1201.2 Requirements for Major Alterations

When any major alteration as defined in Rule 1201.1a is made, it shall conform to the applicable requirements hereinafter specified.

1201.2a *Major Alterations Listed in Rule 1200.1a.*

Where any alteration listed in Rule 1200.1a is made it shall conform to the applicable requirements specified in Rule 1200.2, provided that where reference is made therein to the rules of Part II such reference shall, in the case of hydraulic elevators, be to the corresponding applicable rules in Part III. (See Rule 1201.2b for additional requirements.)

1201.2b *Additional Requirements.*

The following additional requirements shall apply where major alterations are made:

1 *Replacement of Existing Valves, Supply Piping and Fittings.* Where an existing control valve is replaced with a valve of a different type or where relief or check valves or the supply piping and fittings are replaced with new, the parts replaced shall conform to the applicable requirements of Section 303.
2 *Replacement of Existing Tanks.* Where existing tanks are replaced with new, the new tanks shall conform to the requirements of Section 304.
3 *Installation of Interlocks, Combination Mechanical Locks and Electric Contacts, and Car Door or Gate Electric Contacts, on Existing Rope, Lever, Wheel or Rod Operated Elevators.* Interlocks and car door or gate electric contacts shall not be installed on existing elevators having rope, lever, wheel or rod operating devices unless

the elevator is provided with electrically controlled valves, operating devices and control equipment including anti-creep leveling devices, and terminal stopping devices conforming to the applicable requirements of Part III.

EXCEPTION: Elevators having rope operation are not required to have electrically controlled valves, provided a magnetic-type rope lock is installed on the car.

4 *Repairs and Replacement of Damaged, Broken or Worn Parts.* In addition to conforming to the requirements of Rule 1200.3 such repairs and replacements shall also be subject to the requirements of Rules 1201.2b-1 and 1201.2b-2.

5 *Additional Terminal Speed Limiting Devices Required.* Where electrically operated valves are installed to replace existing mechanically operated valves, for rated speeds of more than one hundred (100) feet per minute, existing terminal stopping devices consisting of an automatic stop valve independent of the normal control valve and operated by the movement of the car as it approaches the terminals, where provided, shall be retained.

6 *Replacement of Plunger or Cylinder.* Where an existing plunger or cylinder is replaced by a plunger or cylinder of different material, size or design, the new plunger or cylinder shall conform to the requirements of Rules 302.2 and 302.3 respectively.

7 *Increase in Working Pressure.* Where the working pressure is increased, the plunger or piston, cylinder, valves, piping and fittings, and tanks shall conform to the requirements of Sections 302, 303 and 304 respectively.

SECTION 1202 — HAND ELEVATORS

Rule 1202.1 Addition of Power Drives to Hand Elevators

Power other than hand shall not be applied for driving a hand elevator unless the entire installation is made to conform to all the requirements for electric elevators in Parts I and II. A change of this type shall be considered a major alteration. (See also Rule 609.1.)

Rule 1202.2 Repairs and Replacements of Damaged, Broken or Worn Parts

Ordinary repairs and replacements of damaged, broken or worn parts, necessary for normal maintenance, may be made with parts of equivalent material, strength and design. Broken or damaged parts subject to tension, torsion or bending, or parts on which the support of the elevator car depends, shall not be repaired by welding.

PART XIII

DESIGN DATA AND FORMULAS

SCOPE

**This part presents certain design data, formulas, and charts which provide information useful to a designer.

SECTION 1300 — MINIMUM RATED LOAD OF PASSENGER ELEVATORS

Rule 1300.1 Minimum Rated Load, Passenger Elevators

The following formulas shall be used for determining the minimum rated load of passenger elevators:

a For an elevator having an inside net platform area of not more than fifty (50) square feet, $W = 0.667A^2 + 66.7A$.

b For an elevator having an inside net platform area of more than fifty (50) square feet, $W = 0.0467A^2 + 125A - 1367$.

Where W = minimum rated load in pounds, and A = inside net platform area in square feet.

Figures 1300.1 (I), (II) and (III) give the minimum rated loads for various inside net platform areas.

SECTION 1301 — ELECTRIC ELEVATOR CAR-FRAME AND PLATFORM STRESSES AND DEFLECTIONS

Rule 1301.1 General Requirements

The stresses and deflections in side-post-type car-frame and platform members shall be based on the data and formulas listed in this Section. The maximum allowable stresses and deflections shall be not more than those permitted by Table 203.10 and Rule 203.11.

For cars with corner-post or underslung-type car frames, the formulas and specified methods of calculation do not generally apply and shall be modified to suit the specific conditions and requirements in each case.

*Stresses and deflections in addition to those based on the data and formula in this section shall be considered when side-post-type car frames are located off the platform centerline by more than one-eighth (⅛) of the distance from the front to the back of the platform.

Rule 1301.2 Car-Frame Crosshead

The stresses in the car-frame crosshead shall be based on the total load supported by the crosshead with the car and its rated load at rest at the top terminal landing.

Rule 1301.3 Car-Frame Plank (Normal)**

The stresses in the car-frame plank when the stringers are supported directly on the plank members, shall be the sum of five-eighths (⅝) of the platform weight uniformly distributed plus the concentrated loads due to the tension in the means of compensation and the traveling cables plus (a) or (b):

a For passenger and Class A freight loading, five-eighths (⅝) of the rated load uniformly distributed.

b For Class B and C freight loading, the loading as specified in Rule 1301.6.

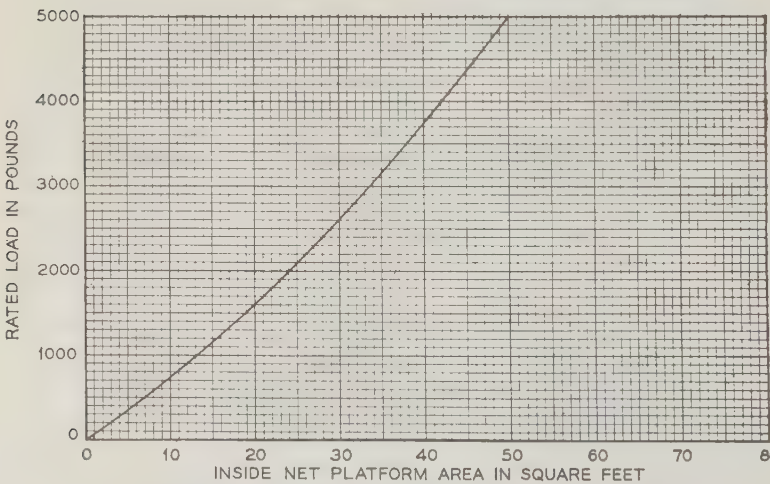


Fig. 1300.1 (I) Minimum Rated Loads for Passenger Elevators

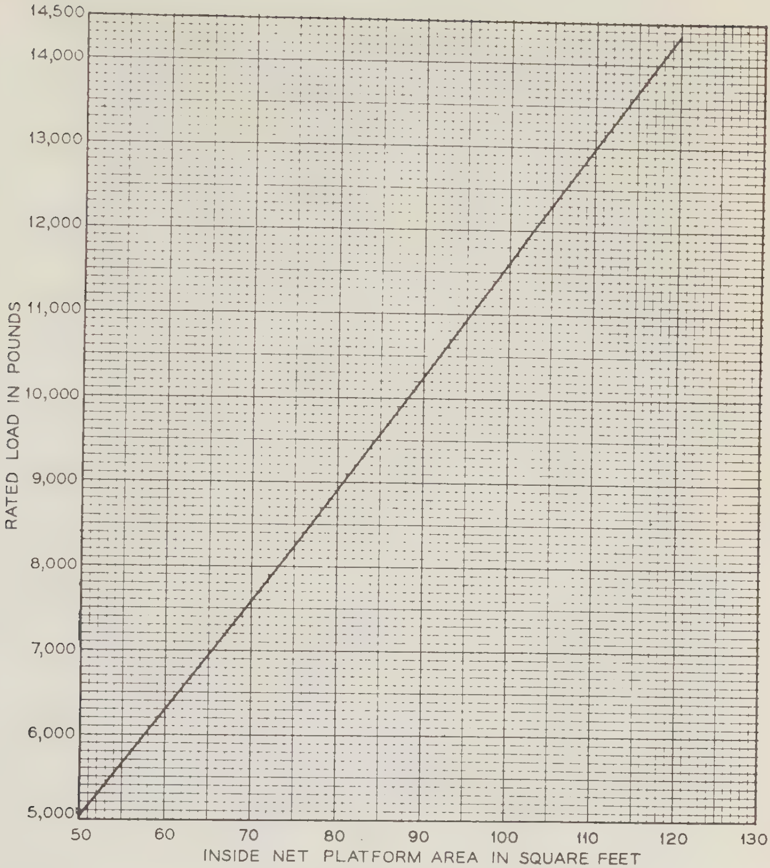


Fig. 1300.1 (II) Minimum Rated Loads for Passenger Elevators

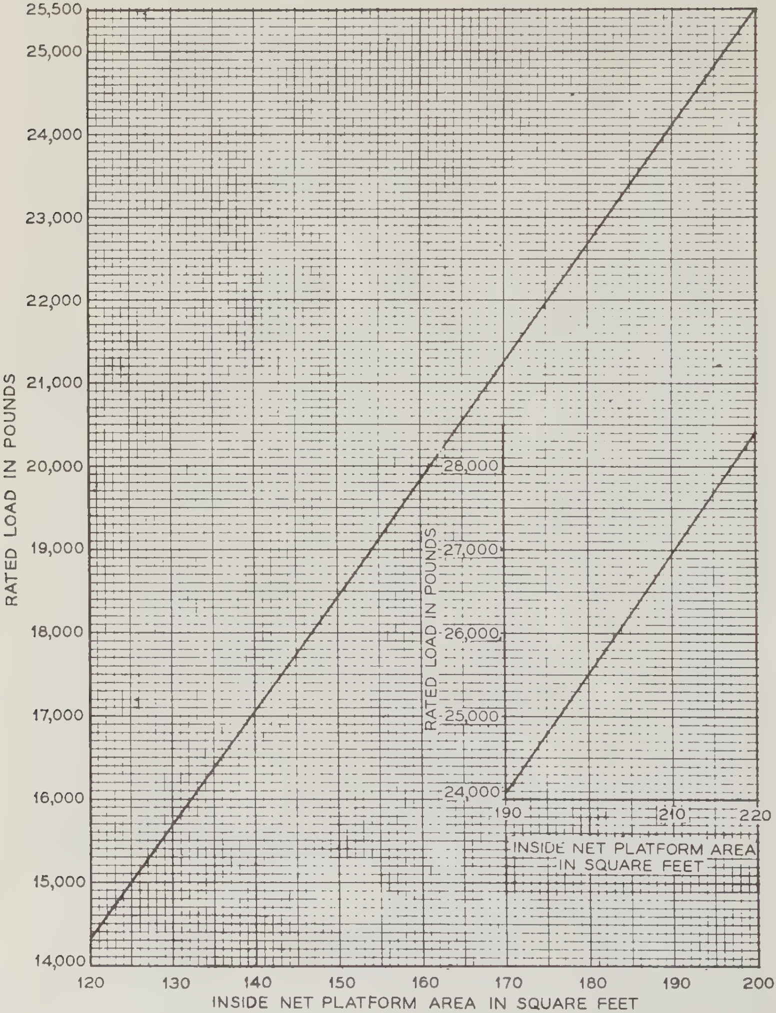


Fig. 1300.1 (III) Minimum Rated Loads for Passenger Elevators

Rule 1301.4 Car-Frame Plank (Buffer Engagement)

In calculating the stress resulting from oil-buffer engagement, one-half (½) the sum of the weight of the car and its rated load shall be considered as being concentrated at each end of the plank with the buffer force applied at the middle. The buffer force shall be considered to be that required to produce gravity retardation with rated load in the car.

The following formula shall be used to determine the stress resulting from buffer engagement:

$$\text{Stress} = \frac{D\,(C+W)}{2Z}$$

Where more than one oil buffer is used, the formula shall be modified to suit the location of the buffers.

NOTE: Symbols used in the above formula are defined in Rule 1301.7.

Rule 1301.5 Car-Frame Uprights (Stiles)

The total stress in each car-frame upright due to tension and bending, and the slenderness ratio of each upright and its moment of inertia shall be determined in accordance with the following formulas:

a** *Stress Due to Bending and Tension.*

$$\text{Total stress} = \frac{KL}{4HZ_u} + \frac{G}{2A}$$

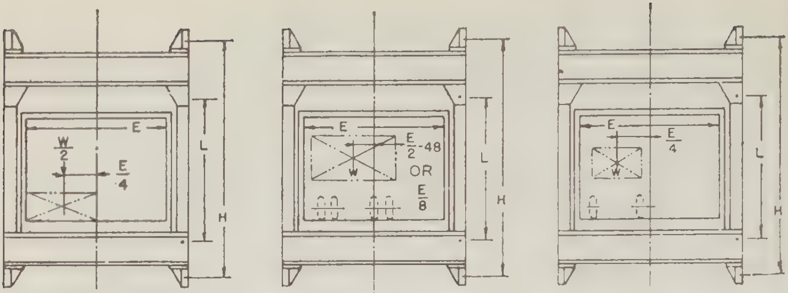
Where $\frac{KL}{4HZ_u}$ is the bending stress in each upright in the plane of the frame due to live load W on the platform for the class of loading A, B or C for which the elevator is to be used (see Rule 207.2b) $\frac{G}{2A}$ is the tensile strength in each upright and K is determined by the following formulas (see Figure 1301.5a):

1 For class A freight loading or passenger loading, $K = \frac{WE}{8}$

2 For class B freight loading, $K = W\left(\frac{E}{2} - 48\right)$ or $K = \frac{WE}{8}$ whichever is greater.

3** For class C freight loading, $K = \frac{WE}{4}$

NOTE: Symbols used in the above formulas are defined in Rule 1301.7.



$K = \frac{WE}{8}$

$K = W\left(\frac{E}{2} - 48\right)$ OR $K = \frac{WE}{8}$ WHICHEVER IS GREATER

$K = \frac{WE}{4}$

CLASS A FREIGHT LOADING OR PASSENGER LOADING

CLASS B FREIGHT LOADING

CLASS C FREIGHT LOADING

Fig. 1301.5a Turning Moment Based on Class of Loading

b *Slenderness Ratio.*

The slenderness ratio L/R for uprights subject to compressions other than those resulting from safety and buffer action shall not exceed one hundred and twenty (120).

EXCEPTION: Where the upper side-brace connections on passenger elevator car-frame uprights are located at a point less than two-thirds (2/3) of L from the bottom. (top fastening in car-frame plank) a slenderness ratio of L/R not exceeding one hundred and sixty (160) shall be permissible.

NOTE: Symbols used in the above formulas are defined in Rule 1301.7.

c *Moment of Inertia.*

The moment of inertia of each upright shall be not less than determined by the following formula:

$$I = \frac{KL^3}{18EH}$$

NOTE: Symbols used in the above formula are defined in Rule 1301.7.

Rule 1301.6* Freight Elevator Platform

The calculations for stresses in the platform members of freight elevators shall be based on the following concentrated loads assumed to occupy the position which will produce the maximum stress:

a *For Class A Loading.* One-quarter (¼) of the rated load.
b *For Class B Loading.* Seventy-five (75) percent of the rated load divided into two (2) equal parts, five (5) feet apart.
c *For Class C1 Loading with a Load Rating of Twenty Thousand (20,000) Pounds or Less.* Eighty (80) percent of the rated load divided into two (2) equal parts, two (2) feet six (6) inches apart.
d *For Class C2 Loading with a Load Rating of Twenty Thousand (20,000) Pounds or Less.* Eighty (80) percent of the rated load or of the loaded truck weight, whichever is greater, divided into two (2) equal parts, two (2) feet six (6) inches apart.
e *For Class C1 or C2 Loading with a Rated Load in Excess of Twenty Thousand (20,000) Pounds.* Eighty (80) percent of the twenty thousand (20,000) pounds or of the maximum loaded truck weight, whichever is greater, divided into two (2) equal parts, two (2) feet six (6) inches apart.
f *For Class C3 Loading.* Determined on the basis of the actual loading conditions but not less than that required for Class A loading.

Rule 1301.7 Formula Symbols

The symbols used in the formulas in this Section shall have the following meanings:

W = Rated load in pounds.
C = Net weight in pounds of complete elevator car.
G = Load in pounds supported by crosshead with rated load in car at rest at top terminal landing.
K = Turning moment in inch-pounds as determined by class of loading.
D = Distance in inches between guide rails.
E = Inside clear width of car in inches, except in formulas 1301.5-c and 1303.1d-4 where E = modulus of elasticity (psi) of the material used.
H = Vertical center distance between upper and lower guide shoes (or rollers) in inches.
L = Free length of uprights in inches (distance from lowest fastening in crosshead to top fastening in plank).
A = Net area of section in (inches)^2
R = Least radius of gyration of section in inches.
I = Moment of inertia of member, gross section in (inches)^4.
Z = Combined section moduli of plank members, gross section, (inches)^3.
Z_u = Section modulus of one upright, gross section, (inches)^3.

SECTION 1302 — HYDRAULIC MACHINES AND PIPING

Rule 1302.1 Plunger Design

Plungers shall be designed and constructed in accordance with one of the following formulas:

a *Plungers Not Subject to Eccentric Loading.*

1 *Where slenderness ratio of plunger is less than 120.*

$$\frac{W}{A} = 13600 - 0.485\left(\frac{L}{R}\right)^2$$

2 *Where slenderness ratio of plunger is greater than 120.*

$$\frac{W}{A} = \frac{95,000,000}{\left(\frac{L}{R}\right)^2}$$

where:

W = Allowable gross weight to be sustained by plunger. Where a counterweight is provided, the weight of the counterweight plus the unbalanced weight of the counterweight ropes may be deducted in determining W. In determining W, one-half (½) of the weight of the plunger shall be included except where a plunger-follower guide, conforming to Rule 302.2h, is used in which case three-quarters (¾) of the plunger weight shall be included.

A = Net sectional area of plunger (area of metal) in square inches.

L = Maximum free length of plunger in inches. Where a plunger-follower guide, conforming to Rule 302.2h, is used, L shall be taken as one-half (½) the amount that the free length would be if no follower guide was provided.

R = Radius of gyration of plunger section in inches.

$\frac{W}{A}$ = Maximum allowable fiber stress.

EXCEPTION: Plungers having a free length of twenty-five (25) feet or less may be accepted without further examination for strength and elastic stability provided all of the following conditions exist:

(1) The working pressure is three hundred (300) pounds per square inch or less.

(2) The plunger is four (4) inches nominal pipe size or larger.

(3) Pipe not lighter than schedule forty (40) is used and not more than one-sixteenth (1/16) inch of metal has been removed from the wall thickness in machining.

NOTE: Charts Figs. 1302.1a (1) and 1302.1a (2) have been calculated from the formulas given in Subdivision a of this Rule for the more usual pipe sizes and pipe schedules and indicate allowable gross loads directly.

b *Plungers Subject to Eccentric Loading.* For plungers subject to bending, the stresses due to bending as determined by the following formula shall be subtracted from the stresses W/A as determined by the applicable formula in Subdivision (a) for this Rule:

$$S = \frac{W_b e}{Z}$$

where:

S =Stress due to bending.

W_b =Maximum eccentric load in pounds. Where any or all of this load is caused by moving wheel loads imposed on the edge of the platform, the total of such loads shall be doubled for impact (See Rule 1301.6).

e =Eccentricity of W_b in inches.

Z =Section modulus of plunger section $(\text{inches})^3$.

c *Plungers Subjected to External Pressure.* For plungers subjected to external pressure, the working pressure shall be not more than that indicated by the following formula:

1 Where the ratio of t/d is less than 0.023:

$$p = 333 \left[1 - \sqrt{1 - 1600\left(\frac{t}{d}\right)^2}\,\right]$$

2 Where the ratio of t/d is greater than 0.023:

$$p = 28890\,\frac{t}{d} - 462$$

where:

p = Working pressure in pounds per square inch.

t = Finished wall thickness in inches.

d = External finished diameter in inches.

Rule 1302.2 Cylinder Design

Cylinders shall be designed and constructed in accordance with the following formula:

$$t = \frac{pd}{2S}$$

where:

t = Thickness of wall in inches, minimum.

p = Working pressure in pounds per square inch.

d = Internal diameter in inches.

S = Design stress in pounds per square inch 12,000 psi maximum for mild steel and one-fifth (1/5) the ultimate strength for other metals.

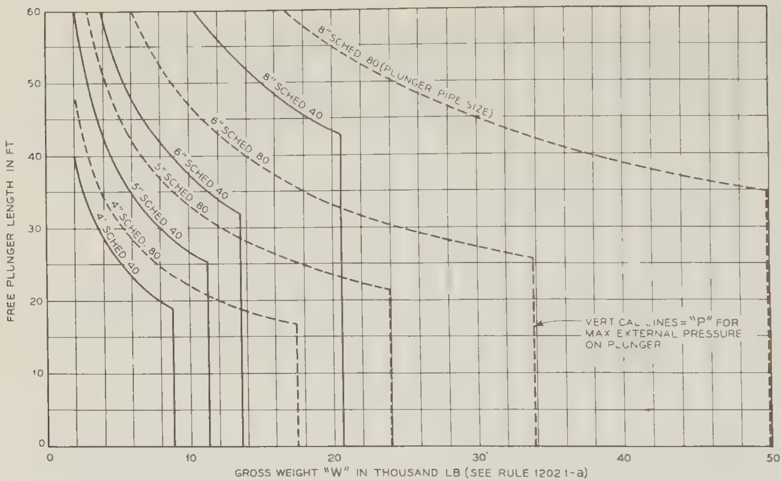


Fig. 1302.1a(1) Allowable Gross Loads

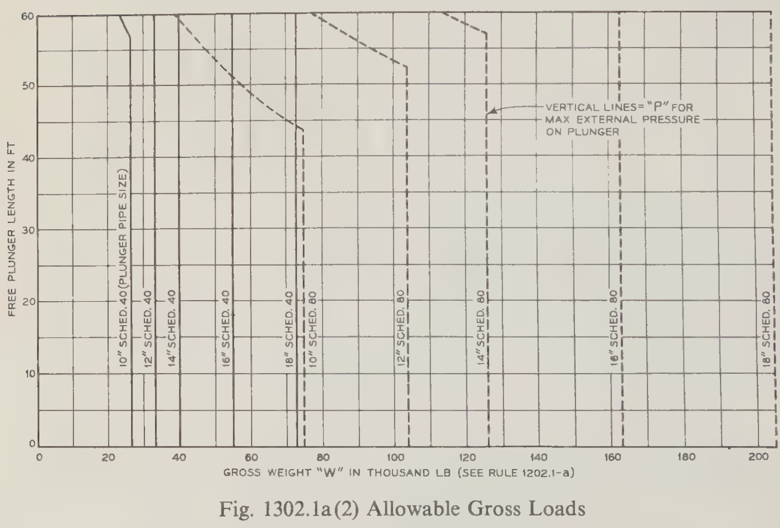


Fig. 1302.1a(2) Allowable Gross Loads

Note 1: Curves are based upon the removal of not more than 1/16 inch from the wall thickness in machining.

Note 2: Curves stop at 60-foot length for convenience only. For plunger sizes or lengths not shown on this chart see the applicable formula in Rule 1302.1-a.

Rule 1302.3 Cylinder and Plunger Heads

Heads of cylinders and heads of plungers subject to fluid pressure shall be designed and constructed in accordance with one of the following applicable formulas:

a *Flat unreinforced heads*

$$t = d\sqrt{\frac{p}{4S}}$$

b** *Dished seamless hemispherical heads, concave to pressure*

$$t = \frac{5pr}{6S}$$

c** *Dished seamless elipsoidal heads, concave to pressure [elipsoidal heads in which one-half (1/2) of the minor axis equals one-fourth (1/4) the inside diameter of skirt]*

$$t = \frac{5pD}{6S}$$

where:

t = Thickness of head in inches, minimum.
d = Diameter of head between supporting edges in inches.
D = Inside diameter of skirt in inches.
p = Working pressure in pounds per square inch.
S = Design stress in pounds per square inch [12,000 psi maximum for mild steel and one-fifth (1/5) ultimate strength for other materials.]
r = Radius to which head is dished, measured on concave side in inches (not greater than d).

Rule 1302.4 Pipe Design

The minimum wall thickness of pipe for working pressures over two hundred and fifty (250) pounds per square inch shall be determined by the following formula:

$$t = \frac{pD}{2S} + C$$

where:

D = Outside diameter of pipe in inches.
t = Minimum wall thickness in inches.
p = Working pressure in pounds per square inch.
C = 0.050 for threaded pipe up to ⅜ inch pipe size.
Depth of thread in inches, for threaded pipe over ⅜ inch pipe size.
Depth of groove in inches, for grooved pipe.
0.000 for other pipe of unreduced thickness.
S = Allowable stress in pounds per square inch [one-fifth (1/5) ultimate strength].

SECTION 1303 — HYDRAULIC ELEVATOR CAR-FRAME AND PLATFORM STRESSES AND DEFLECTIONS

Rule 1303.1 General Requirements

The stresses and deflections in car frame and platform members shall be based on the data and formulas listed in this section. For cars with corner-post or sub-post car frames, the formulas and data do not generally apply and shall be modified to suit the specific conditions in each case.

*Stresses and deflections in addition to those based on the data and formulas in this section shall be considered when side-post type car frames are located off the platform centerline by more than one-eighth (⅛) of the distance from the front to back of the platform.

1303.1a *Maximum Stresses in Car Frame Uprights.*

The maximum stresses in car frame uprights which are normally subject to compression shall be such that the quantity $[(f_a/F_a) + (f_b/F_b)]$ does not exceed unity.

Where:

F_a = Allowable axial compressive unit stress [not exceeding $17000 - 0.485\left(\frac{L}{R}\right)^2$].

F_b = Allowable bending unit stress (15,000 psi if area basis is gross section or 18,000 psi if area basis is net section).

f_a = Actual axial compressive unit stress based on gross section.

f_b = Actual bending unit stress.

L = Free length of uprights in inches (distance from lowest fastening in cross head to top fastening in plank).

R = Least radius of gyration of section in inches.

1303.1b *Car-Frame Crosshead.*

The stresses in the car-frame crosshead shall be based on the total load, if any, supported by the crosshead.

The moment of inertia in the crosshead shall be not less than twice that of the stile section about an axis parallel to that of the crosshead section. The connection between the crosshead and the stile shall have sufficient rigidity to transmit the bending moment in the stile into the crosshead.

1303.1c *Car-Frame Plank.*

The normal stresses in the car-frame plank for elevators having a single plunger shall be based on a load equal to one-half (½) the maximum static load on the plunger concentrated at each end of the

plank with the plunger force applied at the middle. Where multiple plungers are used the stresses shall be analyzed for the specific case. Stresses resulting from oil-buffer engagement shall be calculated in accordance with Rule 1301.4.

1303.1d *Car-Frame Uprights (Stiles).*

The stresses in each car-frame upright due to compression and bending and the slenderness ratio of each upright and its moment of inertia shall be determined in accordance with the following formulas:

1 *Stresses Due to Bending.*

$$f_b = \frac{KL}{4HZ_u}$$

where:

f_b =The bending stress in each upright in the plane of the frame due to the live load W on the platform for the class of loading A, B, or C for which the elevator is to be used (See Rules 207.2b and 301.10)

K =Turning moment in inch-pounds as determined by the class of loading (See Fig. 1301.5-a) by the following formulas:

a For Class A freight loading or passenger loading, $K = \frac{WE}{8}$

b For Class B freight loading, $K = W\left(\frac{E}{2} - 48\right)$ or $K = \frac{WE}{8}$ whichever is greater.

c For Class C freight loading, $K = \frac{WE}{4}$

For explanation of symbols L, H and Z_u see Rule 1301.7.

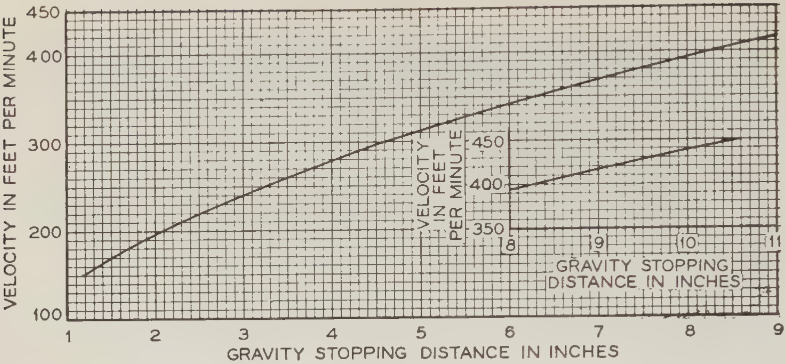
2 *Stresses Due to Compression.*

f_a = Compressive stress in each upright.

3 *Slenderness Ratio.*

The senderness ratio $\frac{L}{R}$ for uprights subject to compressions other than those resulting from buffer action shall not exceed one hundred and twenty (120).

EXCEPTION: Where the upper side-brace connections on passenger elevator car-frame uprights are located at a point less than two-thirds (2/3) of L from the bottom, (top fastening in car-frame plank) a slenderness ratio of L/R not exceeding one hundred and sixty (160) shall be permissible.



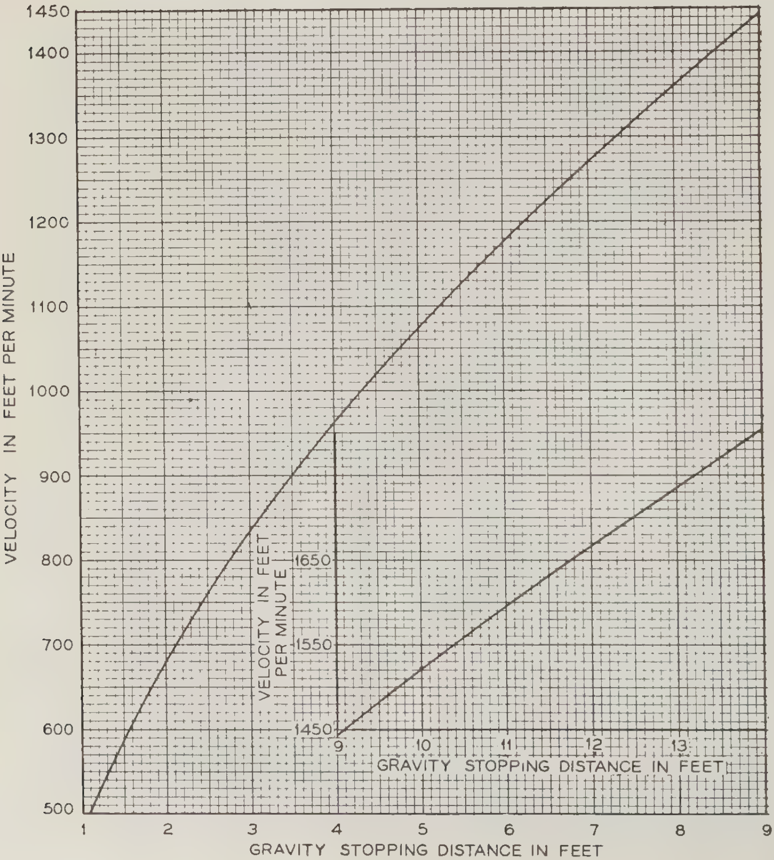


Fig. 1304.1 Gravity Stopping Distances

4 *Moment of Inertia.*

The moment of inertia of each upright shall be not less than determined by the following formula:

$$I = \frac{KL^3}{18EH}$$

For explanation of symbols see Rule 1301.7.

SECTION 1304 — GRAVITY STOPPING DISTANCES

The following formula gives the value of the stopping distance based on gravity retardation from any initial velocity (see Rules 107.1e, g and h, and Rule 201.4a):

$$S = \frac{(V)^2}{19320}$$

where:

V = Initial velocity in feet per minute.

S = Free fall in inches (gravity stopping distance).

Figure 1304.1 shows the gravity stopping distances from various initial velocities.

SECTION 1305 — GOVERNOR TRIPPING SPEEDS

Fig. 1305.1 gives the maximum governor tripping speeds for various rated speeds (See Rule 206.2a).

SECTION 1306 — STOPPING DISTANCES FOR CAR AND COUNTERWEIGHT SAFETIES

The following formulas shall be used to determine the maximum and minimum stopping distances for Type B car and counterweight safeties (see Rule 205.3):

$$S = \frac{(V)^2}{81,144} + 0.84$$

$$* \; S' = \frac{(V)^2}{231,840}$$

where:

S = Max stopping distance in feet.

S' = Min stopping distance in feet.

V = Governor tripping speed in feet per minute.

Fig. 1306.1 (I) to (IV) show the maximum and minimum stopping distances from various governor tripping speeds.

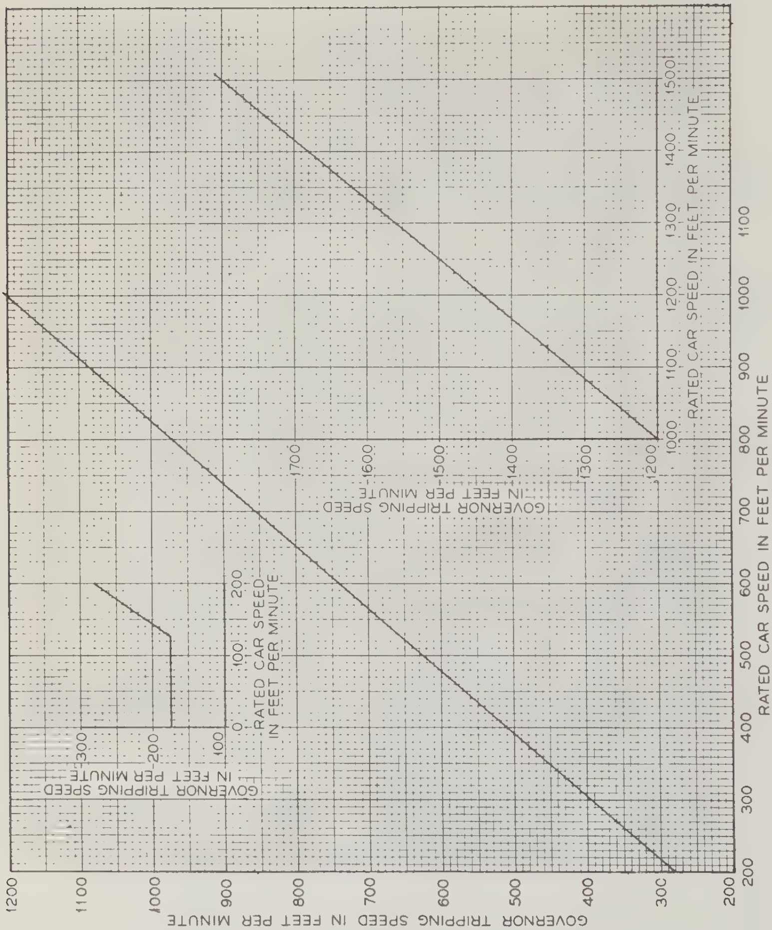


Fig. 1305.1 Maximum Governor Tripping Speeds

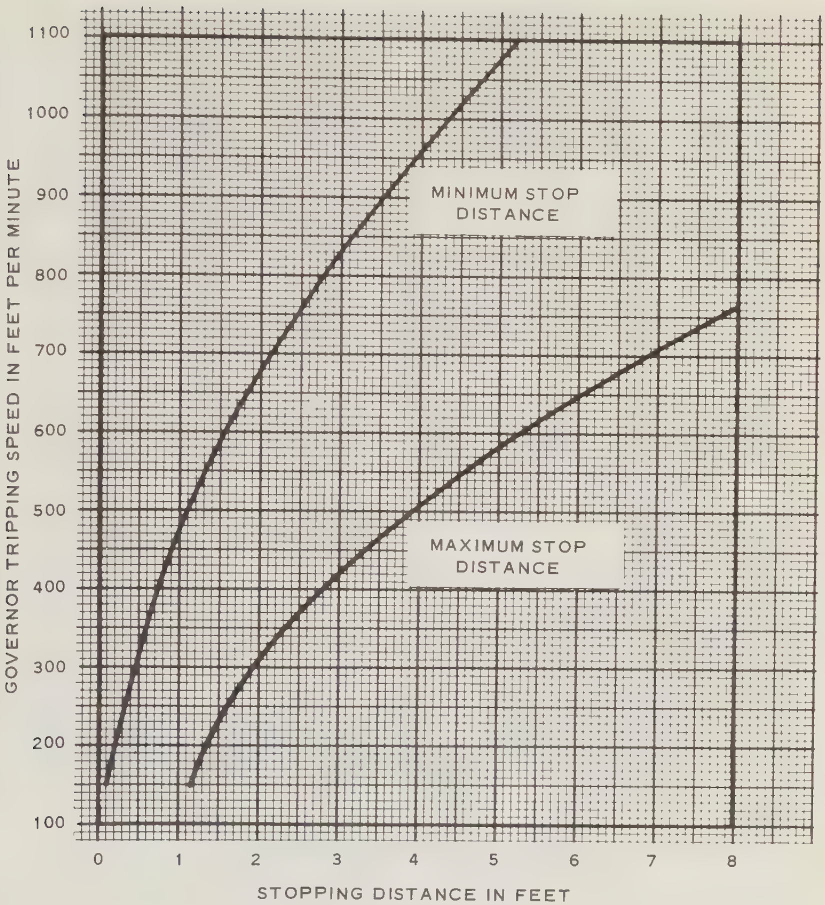


Fig. 1306.1 (I)* Stopping Distances for Type B Car and Counterweight Safeties

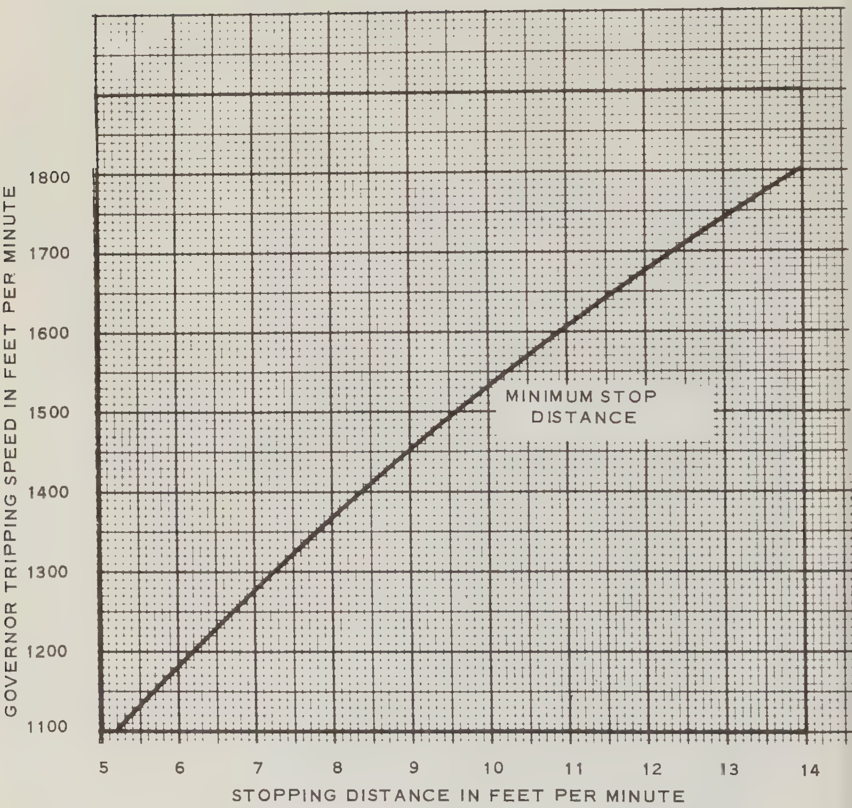


Fig. 1306.1 (II)* Stopping Distances for Type B Car and Counterweight Safeties

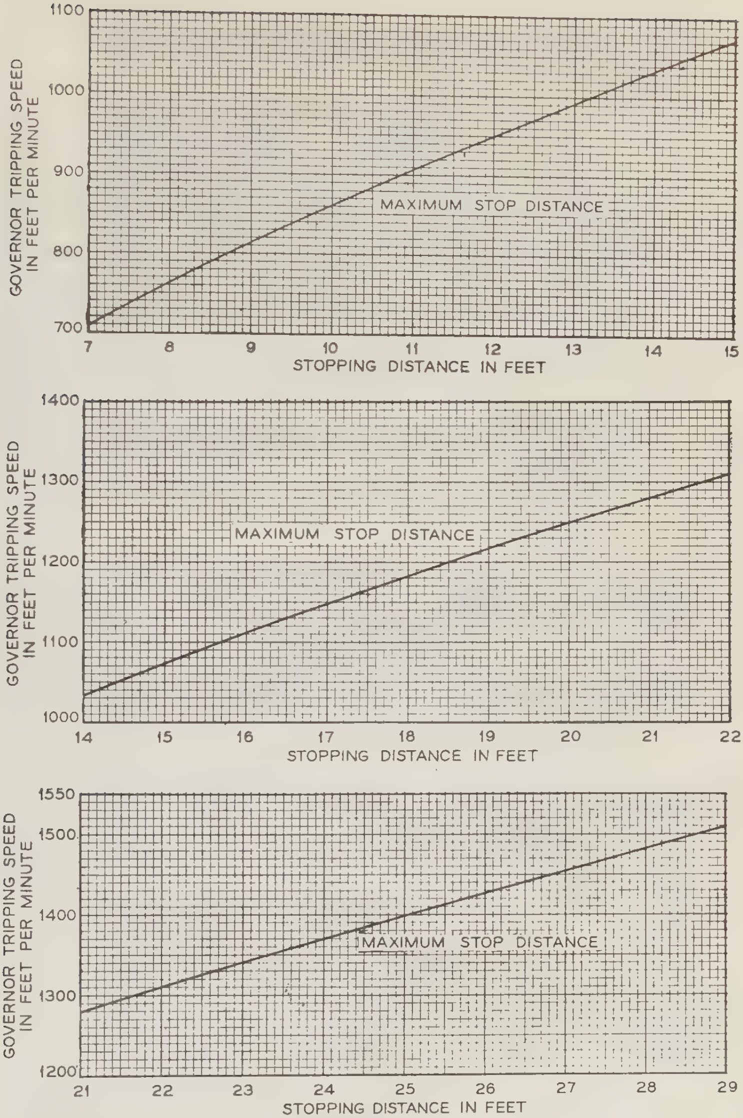


Fig. 1306.1 (III) Stopping Distances for Type B Car and Counterweight Safeties

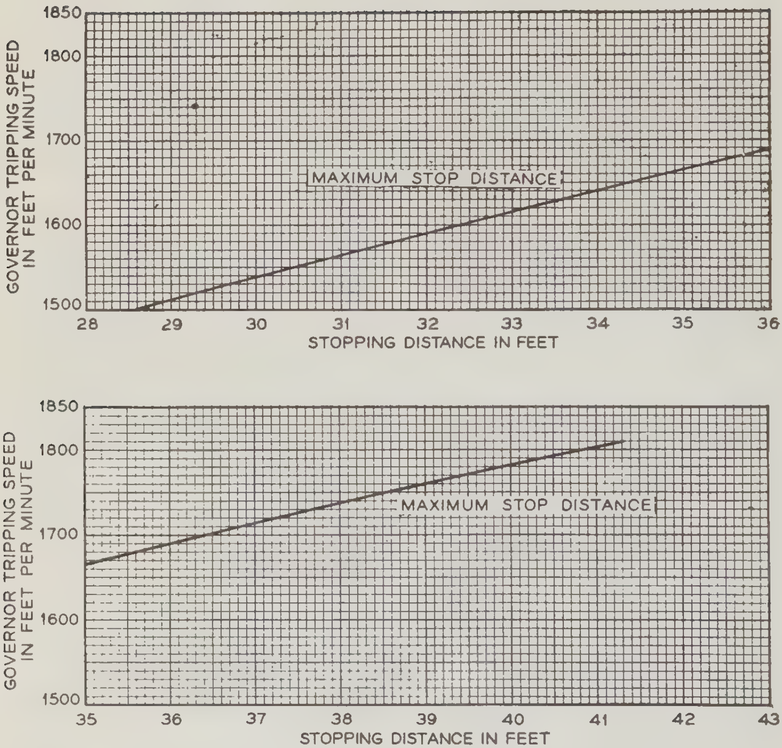


Fig. 1306.1 (IV) Stopping Distances for Type B Car and Counterweight Safeties

SECTION 1307 — FACTORS OF SAFETY FOR SUSPENSION WIRE ROPES FOR POWER ELEVATORS

Fig. 1307.1 shows the factors of safety for suspension wire ropes of power elevators for various rope speeds (see Rule 212.3).

SECTION 1308 — IMPACT ON BUFFER SUPPORTS

The following formulas give the buffer reaction and the impact on the car and counterweight oil buffer supports resulting from buffer engagement (see Rule 109.1):

$$R = W\left(1 + \frac{v^2}{2gS}\right)$$

$$P = 2R$$

The following formulas give the buffer reaction and the impact on the supports of car and counterweight spring buffers which do not fully compress under the conditions outlined in Rule 109.1-b.

$$R = 2W\left(1 + \frac{v^2}{2gS}\right)$$

$$P = R$$

where:

R = Buffer reaction in pounds.

P = Impact in pounds.

where:

**W = Weight of car plus rated load or weight of counterweight in pounds.

v = Speed in feet per second at impact.

S = Buffer stroke in feet.

g = 32.2 feet per second per second.

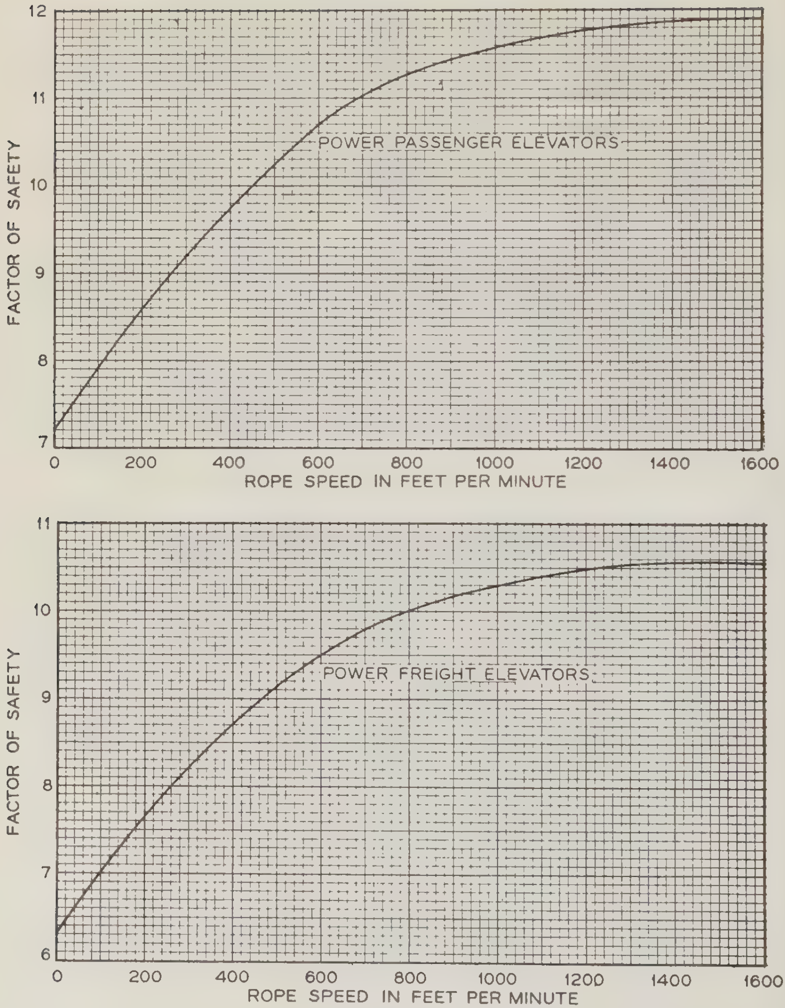


Fig. 1307.1 Factors of Safety of Suspension Wire Ropes of Power Passenger and Freight Elevators

APPENDIX A

Inertia Application Test for Type A Safety Device

Location of Test Weight (See Rule 1000.2b)

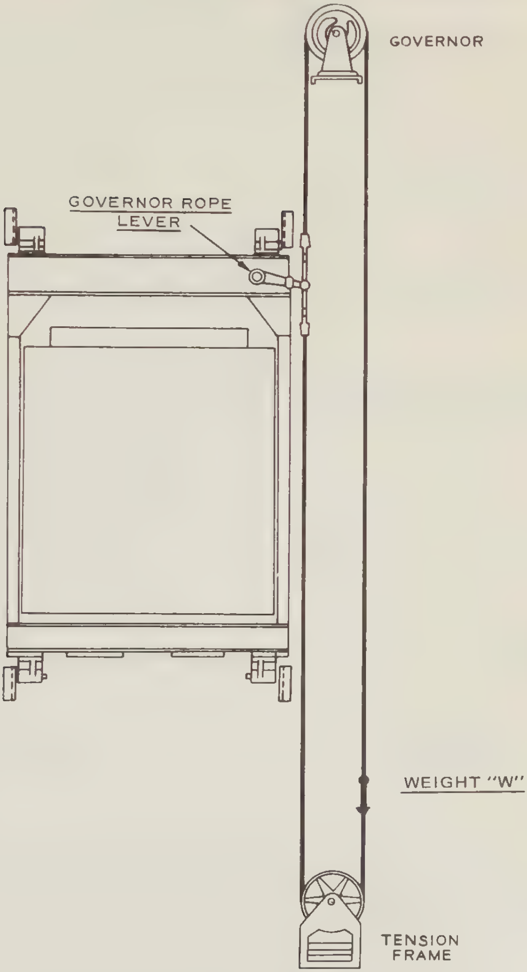


Fig. A1

APPENDIX B

Determination of Top Car and Counterweight Clearances and Bottom Car Clearance

Top Car Clearances

The top car clearance should be determined as shown in Fig. B1 and should not be less than the following (see Rule 107.1e):

(1) Where no sheave or other equipment is mounted in or on the car crosshead or, if so mounted, the dimension b does not exceed 2′-0″

(A) *Where counterweight buffer is not partially compressed when car is level with top terminal landing.*[1]

$$a = e + d + (2'\text{-}0'') + \tfrac{1}{2}g$$

(B) *Where spring-return-type counterweight oil buffer is partially compressed when car is level with the top terminal landing.*[1]

$$a = d' + (2'\text{-}0'') + \tfrac{1}{2}g$$

(C) *In either* (A) *or* (B) *the clearance* c *shall be not less than* $a - (2'\text{-}0'')$ (see Rule 107.1j).

(2) Where a sheave or other equipment is mounted in or on the car crosshead and dimension b exceeds 2′-0″ (see Rule 107.1e-3).

(D) *Where counterweight buffer is not partially compressed when car is level with top terminal landing.*[1]

$$a = e + d + b + \tfrac{1}{2}g$$

(E) *When a spring-return-type counterweight oil buffer is partially compressed when the car is level with the top terminal landing.*[1]

$$a = d' + b + \tfrac{1}{2}g$$

(F) *In either* (D) *or* (E) *the clearance* c *shall be not less than* $a - b$ (see Rule 107.1j).

Where:

a = Distance from top of car crosshead to nearest obstruction directly above it when car floor is level with top terminal landing (overhead car clearance).

[1] The item $\tfrac{1}{2}g$ may be omitted where oil buffers are used and provision is made to prevent the jump of the car at counterweight buffer engagement.

b = Distance, if any, car sheave or any other equipment mounted in or on the car crosshead projects above the crosshead.

c = Distance from top of any equipment located on top of car to nearest obstruction directly above it.

d = Stroke of counterweight oil or spring buffer (for definition of stroke of spring buffer, see Definition).

d' = Uncompressed portion of spring-return-type counterweight oil buffer stroke when car is level with top terminal landing.

e = Bottom runby of counterweight.

g = One of the following (See Rule 107.1e-4):

1. Where a counterweight oil buffer is used, the gravity stopping distance based on one hundred and fifteen (115) percent of rated speed, or
2. If a reduced stroke buffer conforming to Rule 201.4a-2 is used, the counterweight buffer stroke, or
3. Where counterweight spring buffers are used, the gravity stopping distance based on governor tripping speed (see Rule 107.1h-4).

O_1 = Nearest obstruction directly above the car crosshead or above any sheave or other equipment mounted in or on the crosshead.

O_2 = Nearest obstruction directly above any equipment located elsewhere on top of car.

Counterweight Clearances

The top counterweight clearance should be determined as shown in Fig. B2 and B3 and shall be not less than the following (See Rule 107.1h):

(G) *Where car buffer is not partially compressed when car is at bottom terminal landing* (Fig. B2).[1]

$$f \text{ or } f' = h + i \ \ (0'\text{-}6'') + \tfrac{1}{2}g$$

(H) *Where spring-return-type car oil buffer is partially compressed when car is level with bottom terminal landing* (Fig. B3).[1]

$$f \text{ or } f' = i' + (0'\text{-}6'') + \tfrac{1}{2}g$$

Where:

f = Distance from top of counterweight frame or guide shoes where no counterweight sheave is provided, or where if provided it does not project above top of frame, to the nearest obstruction directly above it when car is level with bottom terminal landing.

[1]The item ½*g may be omitted where oil buffers are used and provision is made to prevent jump of the counterweight at car buffer engagement.*

f' = Distance from top of counterweight sheave, where sheave projects above top of frame, to the nearest obstruction directly above it when car is level with bottom terminal landing.
h = Bottom car runby.
i = Stroke of car oil or spring buffer.
i' = Uncompressed portion of car oil buffer when car is level with bottom terminal landing.
g = One of the following (see Rule 107.1h-4):

1. Where a car oil buffer is used, the gravity stopping distance based on one hundred and fifteen (115) percent of rated speed, or
2. If a reduced stroke buffer conforming to Rule 201.4a-2 is used, the car buffer stroke, or
3. Where car spring buffers are used, the gravity stopping distance based on governor tripping speed.

O_3 = Nearest obstruction directly above counterweight.

Bottom Car Clearances

For Type A or B Safety

The bottom car clearance for a type A or B safety should be determined as shown in Fig. B4 and should be not less than the following:

(I) *Where no equipment under the car platform, except as noted in Fig. B4, projects below the bottom of the car frame plank channel.*

$$c = (2'\text{-}0'')$$

(J) *Where any equipment under the car platform, except as noted in Fig. B4, projects a distance* d *below the bottom of the car frame plank channel.*

$$c = d + (2'\text{-}0'')$$

For Type C Safety

The clearance c should be measured from the underside of the auxiliary safety plank when the car buffer in the pit is fully compressed and should be not less than as determined by the preceding formulas.

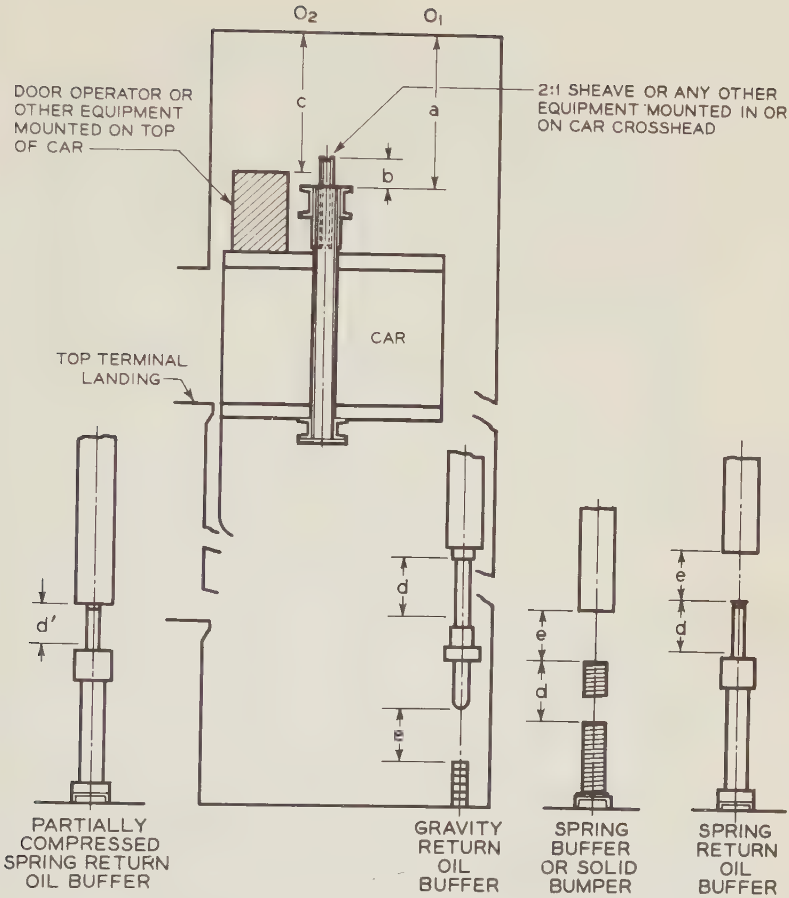


Fig. B1 Top Car Clearances for Counterweighted Elevators With Overslung Car Frames

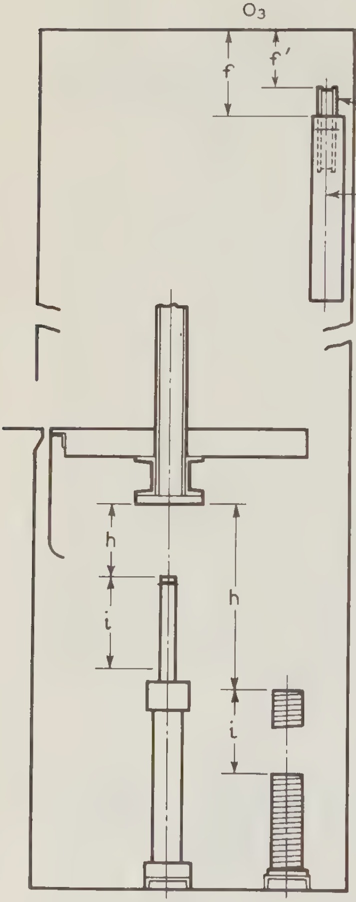


Fig. B2

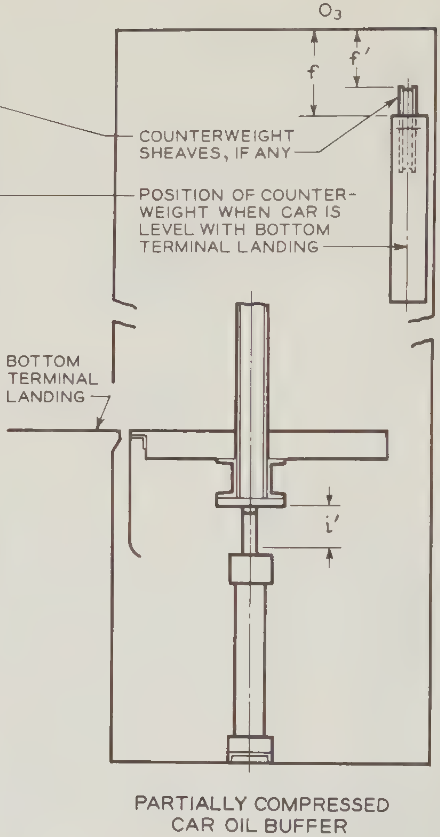


Fig. B3

Top Counterweight Clearances

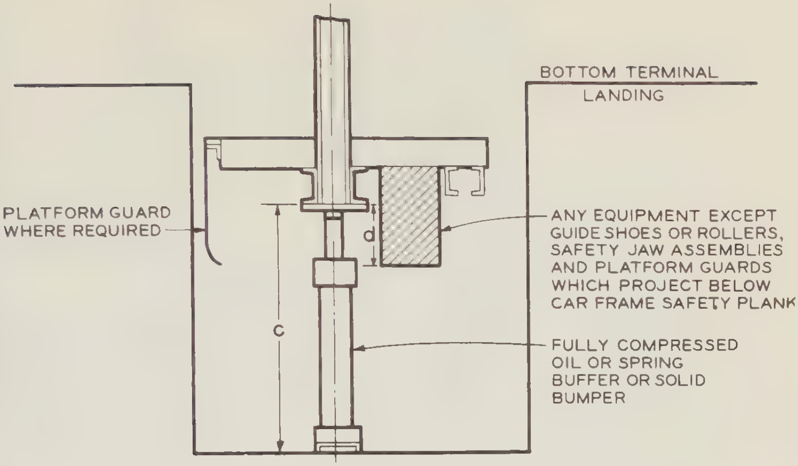


Fig. B4 Bottom Car Clearance

APPENDIX C

DIAGRAMMATIC REPRESENTATION
MEANS OF ACCESS TO CAR TOP OR PIT FOR INSPECTION, MAINTENANCE OR REPAIR, AND MEANS OF ACCESS TO HOISTWAYS FOR EMERGENCY PURPOSES
(SEE RULES 111.9 AND 111.10)

Elevators where a closed door is locked with car at landing; and unopenable from landing.

- **Hoistway Access Switch**

  At one upper landing for top access, and lowest landing for pit access

- OR

- **Hoistway Unlocking Device**
  (same landings) but only if

  For Car Top Access
  Rise is not over 15 feet and access landing not intermediate landing more than 4 feet below top landing.

  For Pit Access
  Pit is no more than

Elevators where a closed door is unlocked with car at landing; or locked but openable by landing means effective only when car is in landing zone. (See Note below)

- **Hoistway Unlocking Device**

  At one upper landing for top access, and lowest landing for pit access

- OR

- **Hoistway Access Switch**

  if preferred (same landings)

- **EMERGENCY USE**

  Emergency Key Device

  Permitted at all landings

Note—With the landing means, it is only necessary to open the doors of any

APPENDIX D

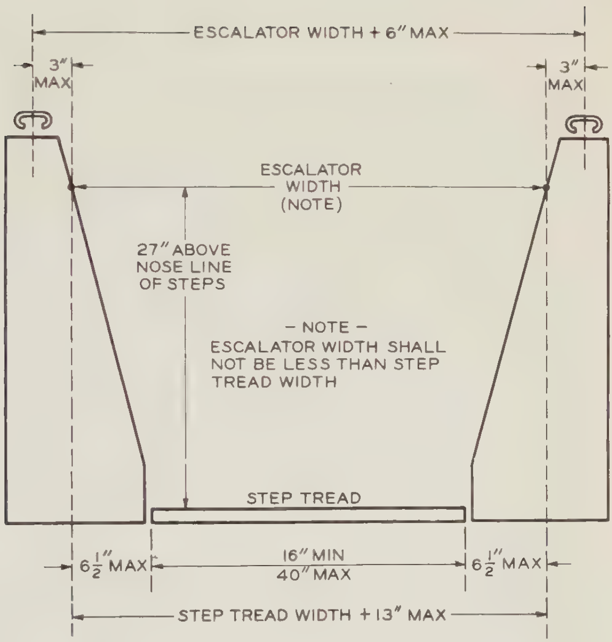


Fig. D1 Relationship of Escalator Parts
(See Rules 802.2, 802.4d, and 802.5b)

APPENDIX E

Operation of Elevators Under Fire or Other Emergency Conditions

The following operation is recommended for the use of firemen and other authorized personnel where the need is established by local authorities having jurisdiction.

NOTE: The type and height of building, and the capabilities of firefighting equipment should be considered when determining where this operation should be required.

A. Automatic passenger elevators shall conform to the following:

(1) A two-position keyed switch shall be provided at a main floor of a single elevator or of each group of elevators. When the switch is in the "ON" position, all elevators controlled by this switch and which are in normal service shall return nonstop to the main floor, and the doors shall open.

(a) An elevator travelling away from the main floor shall reverse at the next available floor without opening its doors.

(b) Door reopening devices for power operated doors (Rule 112.5) which may be affected by smoke or heat so as to prevent door closure shall be rendered inoperative.

(c) Elevators equipped with power operated doors and standing at a floor other than the main floor, with doors open, shall close their doors without delay.

(d) When it is considered safe to do so, the elevators, except those in emergency service [see A(3)], may be returned to normal service by moving the keyed switch to the "OFF" position.

(2) The return to a main floor may be initiated by heat and/or smoke sensing devices in the building independently of the keyed switch required by A(1) except that such devices at the main floor shall not initiate the return of the elevators. If so, the switch required at a main floor shall have three positions. The third position shall restore normal service independent of the heat and/or smoke sensing device.

(3) A keyed switch shall be provided in or adjacent to an operating panel of each elevator. This switch, when operated, shall put the elevator on emergency service.

(a) When on emergency service an elevator shall be operable only by a person in the elevator.

(b) Elevators on emergency service shall not respond to elevator landing calls.

(c) The opening of power operated doors shall be controlled only by continuous pressure "open" buttons or switches. If the open button or switch is released during the "open" motion, the doors shall automatically reclose.

(d) Door reopening devices for power operated doors (Rule 112.5) which may be affected by smoke or heat so as to prevent door closure shall be rendered inoperative.

(4) Keys or the switches required by A(1) and A(3) shall be kept on the premises by the person responsible for the maintenance and operation of the elevators, in a location readily accessible to authorized persons in an emergency, but not where they are available to the public.

B. Elevators operated only by a designated operator in the car shall be provided with a signal system to permit signalling the operator from the main floor to return nonstop to a designated main floor.

Power operated doors and door reopening devices shall conform to A(1)(b) and A(3)(c) and (d).

C. Elevators arranged for dual operation shall, when on automatic operation, conform to A above, and when on operation only by a designated operator in the car, conform to B above.

I N D E X

Note: References given are to the rule numbers, except where page numbers are indicated and where "3" is shown for definitions (see Section 3).

B

G

I

N

REFERENCE